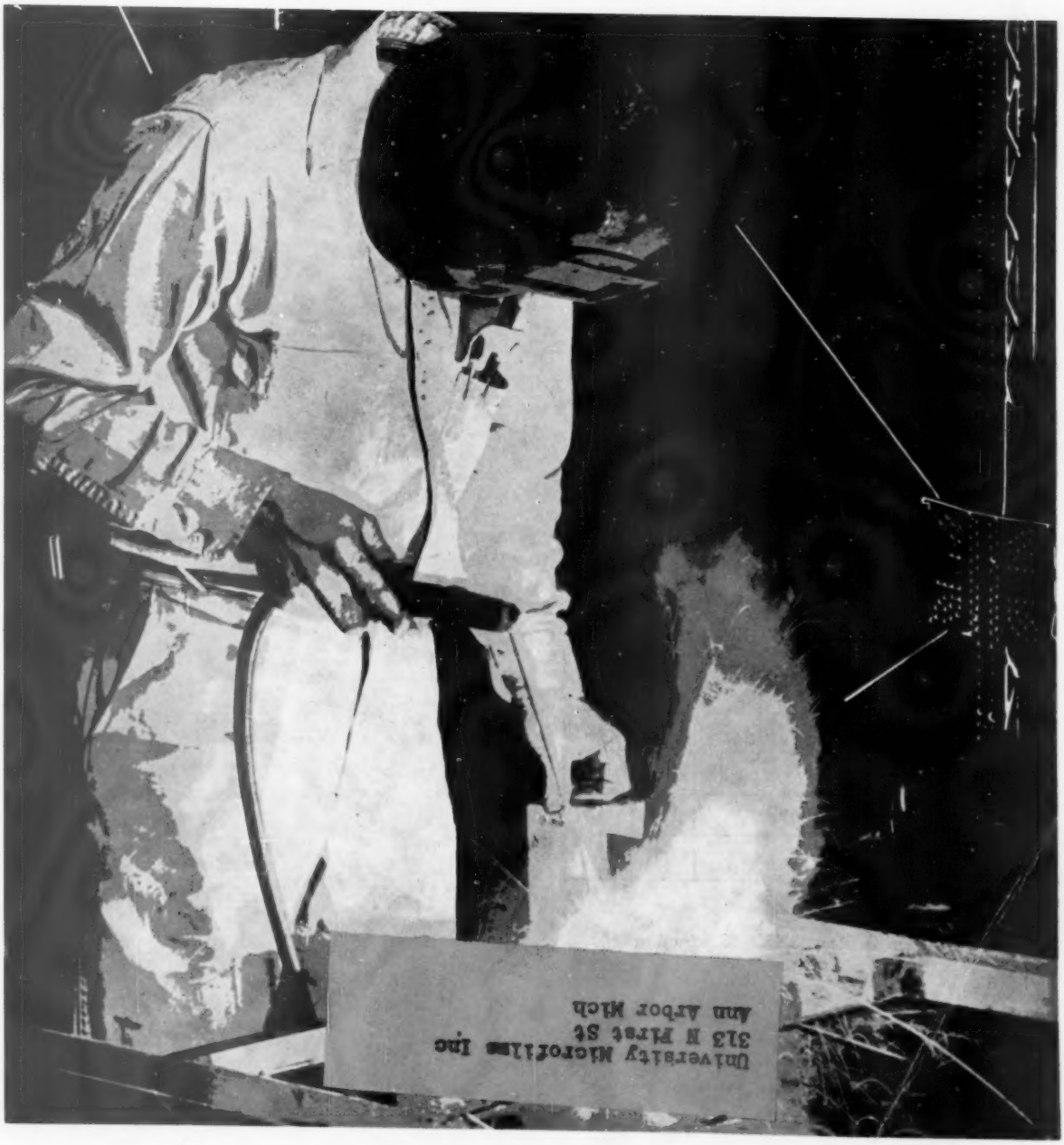
Welding Engineer

NOVEMBER, 1960
50 Cents



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MEDIUM	A-1 & ST-3	1/4"	300 350	1/0 2/0	50%
LARGE	A-3 & ST-5	3/8"	375 450	2/0 3/0	65%
HEAVY-DUTY	A-3S	3/8"	500	4/0	80%

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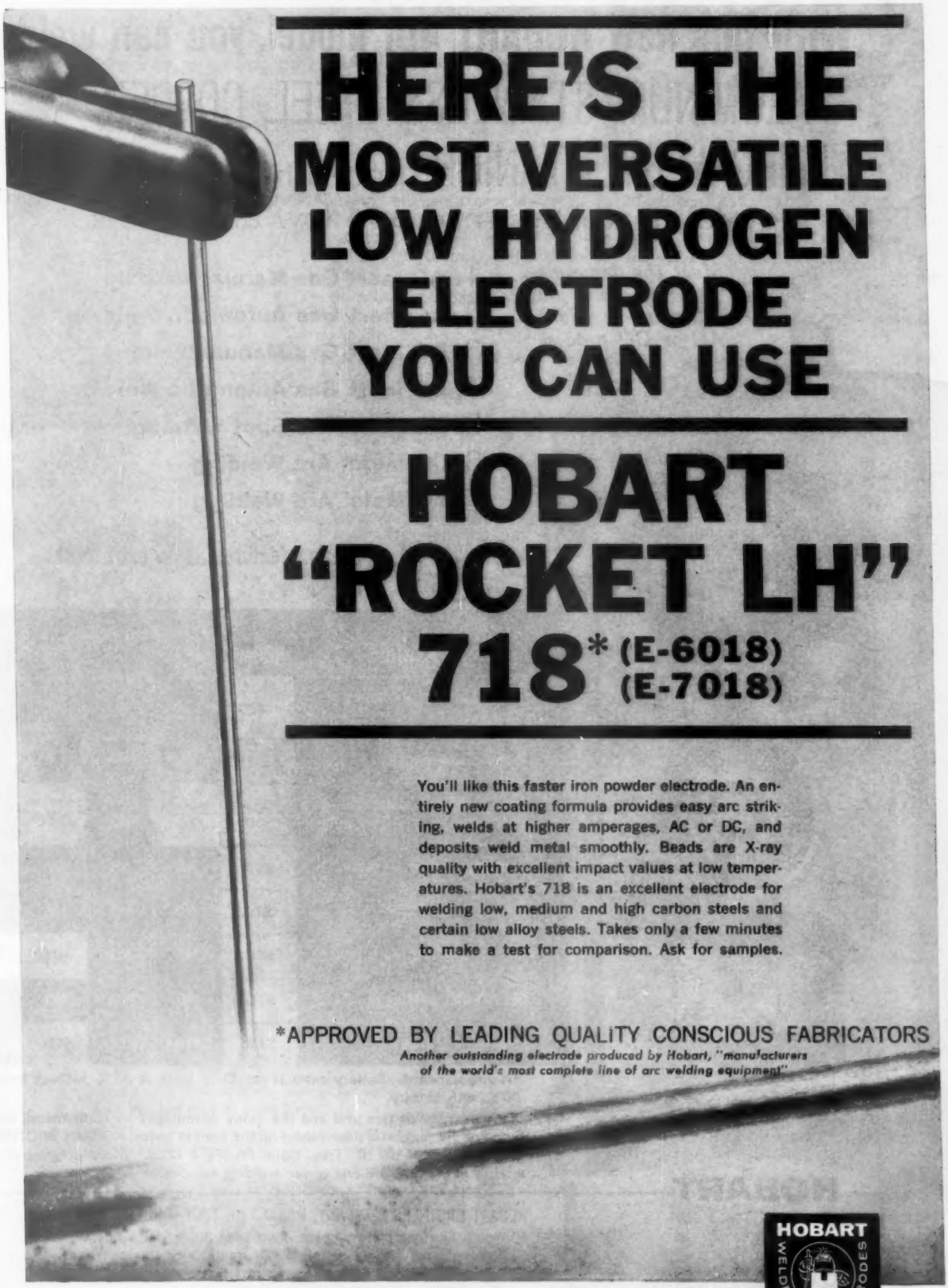
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FEATURES	HOBART	Other make welders #1	#2	#3	#4
Interior protected from valve leak wetting	YES	NO	NO	NO	NO
Water strainer included	STD.	NO	NO	NO	NO
Type stabilizer (standard)	BALLAST	BALLAST	NONE	BATTERY	NONE
duty cycle, %, on AC-Tig welding	60	60	60	35-50*	60
Separate "tig torch" terminal	STD.	NO	NO	NO	NO
Pneumatic timers	STD.	NO	NO	NO	NO
Current overload protection	STD.	NO	NO	STD.	STD.
Gas & water pilot light	STD.	NO	NO	NO	NO
Remote hand rheostat	STD.	EXTRA	EXTRA	STD.	EXTRA

*None standard—Battery extra price. Duty cycle is 35% without battery, 50% with battery.

The versatility of this unit and the many advantages by comparison, make it one of the biggest welder values on the market today. HOBART BROTHERS COMPANY, BOX U-110, Troy, Ohio, Ph. FE 2-1223. *"Manufacturers of the world's most complete line of arc welding equipment"*

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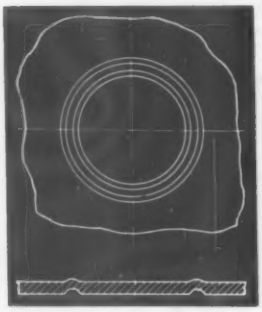
VOL. 45—No. 11

Welding Engineer

The magazine of joining and severing of materials

This is welding: November, 1960

Cover photo . . . is not a drawing, but a normal photograph which was made into a tone separation.

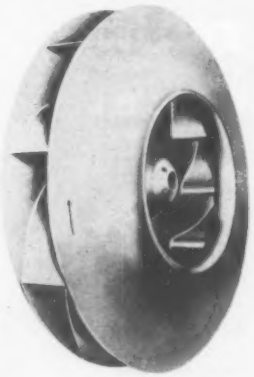


NEMA, Navy announce new electrode specification 37
One military specification will now cover all items common to covered electrodes; NEMA resistance welder control standard revised for easier selection of control equipment for any job.

Welded studs help to double floor load capacity 38
Composite construction design principles doubled the strength of two floors in this 13-story building to accommodate a prospective tenant, as reported by **Irwin G. Cantor.**

Fundamentals of projection welding 40
► ► ► ► Current concentration and even distribution are the advantages of this resistance process detailed by author **Douglas D. Williams.**
★ (For a reprint of this article, circle number 249.)

Rail welding reaches push-button stage 44
Automation takes over oxyacetylene pressure welding on one railroad. In an adjoining story, **F. T. Tancula** discusses the progress of welded rail in this country.



Small stainless tubes Tig welded to thick tube-sheet 46
A specially designed Tig torch was used to weld small tubes to each other and to tube-sheet, as reported by **Dr. J. M. Gerken and D. B. Kittle.**

Welded design, process control for better products 52
► ► ► ► Redesigning for welding and then improving control of the joining process are guaranteed to result in laboratory-proved product strength, according to author **William C. Nemitz.**
★ (For a reprint of this article, circle number 250.)

Oxygen is neither combustible nor explosive 58
Oxygen only supports combustion, and **F. C. Saacke** details safety procedures based on this principle. In an accompanying story, **F. Himmelberger** lists factors in locating oxygen plant sites.

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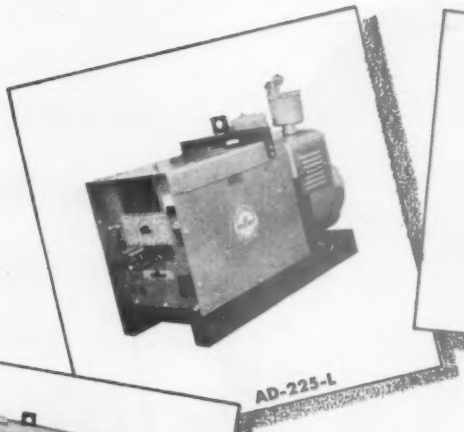
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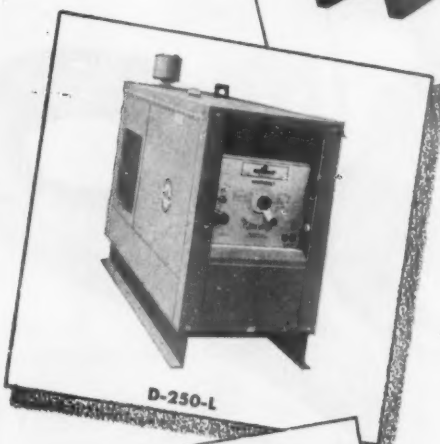
AEA-200-LE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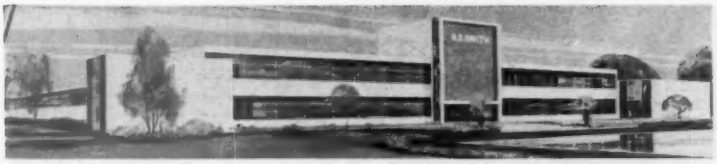


ARTIST'S concept of A. O. Smith Corp.'s new advanced research center at Middleton, Wis., after completion next year.

A. O. Smith to build research center at estimated cost of $2 million

A. O. Smith Corp., Milwaukee, will build an advanced research center at Middleton, Wis., just west of Madison, at an estimated cost of $2 million.

Ground will be broken for the project this fall on an 80-acre tract of land on the northwest edge of Middleton. Advanced research activities are planned to begin in the new facility by the middle of 1961.

Preliminary plans call for construction of a 50,000 sq ft building of modern design to house the firm's advanced research group. Though the cost is estimated at $2 million, L. B. Smith, president, pointed out that this was an estimate and ultimate cost has not been accurately determined.

Research in the new laboratories will be devoted to advanced fields in solid state physics and physical chemistry of materials, as well as the energy processes involved in the utilization of such materials, according to Robert McGinn, vice president of research and development for the company.

In addition, new product developments utilizing the output of this research will be undertaken, thus providing a wide range of research and development activity.

The advanced research laboratories will begin activities with a staff of approximately 50 scientists and technicians, McGinn said, and ultimately a staff of approximately 100 scientists and highly skilled technical people will be employed on various advanced research projects.

One of the major reasons for selecting the Middleton site is its proximity to the University of Wisconsin, a nationally recognized research center.

In announcing the project, Smith said, "Much of the growth and development of our company has been due to past research activities. Our aim in establishing this new research center is to keep pace with, or ahead of the rapid advances in today's science and technology."

November's Headlines

Pepler

Hauser

Fibre-Metal opens southeastern warehouse

A new southeastern warehouse has been opened by The Fibre-Metal Products Co., Chester, Pa. Fibre-Metal Southeast, Inc., of Decatur, Ga., the new warehouse, distributes the firm's products, Glendale Optical Co. products, and J. M. Ragle Industries products to welding and safety supply distributors of the southeastern United States. Services include shipment from Decatur stocks, field sales assistance and promotion and extension of all factory services.

Operations are directed by Deric B. Pepler, general manager, who has completed a training program at both Fibre-Metal Products Co. in Chester and Glendale Optical Co. at Valley Stream, Long Island, N. Y. Joseph J. Hauser has been added to the sales staff.

Lincoln Foundation gives 153 welding awards

A total of $5,000 in 46 awards were made to engineering undergraduates in 21 different colleges, and 107 farm boys from 22 states shared cash awards ranging from $25 to $600 each in national annual welding presentations by the James F. Lincoln Arc Welding Foundation, Cleveland.

A Northwestern University student, Glenn F. Balfanz, Jr., of Cicero, Ill., won first prize of $1,250 in the competition for engineering undergraduate papers on welded machine and structural design.

His paper was on the redesign of a pump discharge head.

Lowell Depping of Walla Walla, Wash., won first award of $600 in the competition for vocational agriculture students with an integrated forage feeding system capable of handling 600 head of dairy cattle.

The foundation annually awards a total of $7,000 to students and high schools for shop projects involving welding. Awards are made on the basis of usefulness and quality of the project and how well and completely it is described.

In the undergraduate awards, the University of Wyoming was first with 15 awards while the University of Illinois was second with four. In the high school competition Tulare Union High of Tulare, Calif., had 11 winners to finish first for the second year in a row.

ENGINEERS bowed to superstition recently when the flag and highest column of the 20-story steel-framed all-welded United Engineering Center was raised by Dreier Structural Steel Co., Inc., Long Island City, N. Y. The building, built with contributions from the 250,000 members of the national engineering societies, including the America Welding Society, is at United Nations Plaza and 47th St., New York City.

Illinois U. to host welding short course

The University of Illinois, in cooperation with AWS, will hold its first biennial short course on welding engineering Dec. 5-8 at Urbana, Ill.

Conducted by the departments of civil engineering, mechanical engineering and mining and metallurgical engineering, the short course will feature such speakers as C. Alexander, Linde Co.; T. B. Jefferson, publisher, WELDING ENGINEER; G. E. Linnert, supervising research welding metallurgist, research labs, Armco Steel Corp.; and W. G. Schumacher, supervisor of electrode and rod research section, National Cylinder Gas Div.

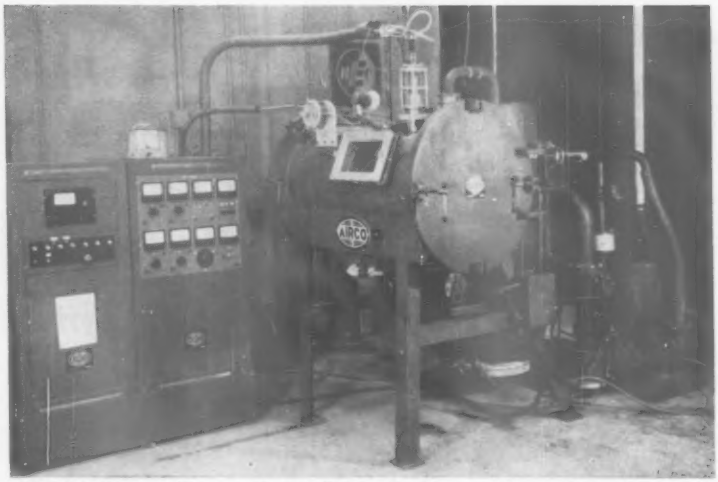
Other featured speakers will be: O. T. Barnett, assistant director metals research, Armour Research foundation; G. E. Claussen, Arcrods Co.; R. W. Tuthill, assistant manager development department, Air Reduction Sales Co.; and a number of professors of engineering from the University of Illinois.

Safety committee visits Sellstrom plant

Ten members of the Safety Committee of the National Constructors Association recently visited the Palatine, Ill., plant of the Sellstrom Mfg. Co., makers of eye and face protection products.

The occasion for the visit was the committee's quarterly meeting in Chicago. Visitors were brought to the Sellstrom plant by helicopter from Chicago 30 miles away.

OPERATION of this new liquid argon unit for use in aluminum welding processes is described by L. W. Oyler, Linde Co., Portland, to Ken Self (left), president and general manager of Freightliner Corp., Portland, Ore., and Merle Fishback (right), production engineer for Freightliner. Designed and installed by Linde for Freightliner, the unit stores the equivalent of 25,000 cu ft of argon in liquid form at about 300 F below zero and automatically converts it to gas as needed.



ELECTRON beam welder recently installed by Rosemount Engineering Co., Minneapolis, is said to be the first of its kind to be installed in a factory for production use.

Rosemount installs electron beam welder

Rosemount Engineering Co., Minneapolis, has installed a $35,000 electron beam welder. In such a welder, the electrons emitted have a potential temperature of millions of degrees.

Since the heat is developed without flame, this energy does not appear until the electrons hit the material to be welded. This concept permits welding of most known exotic materials such as beryllium, molybdenum, columbium, tungsten, titanium, tantalum and others used in rockets and missiles.

Material from 0.003 in. foil sheet to 0.500 in. plate can be welded due to the ability to control the electron penetration. Joint efficiency is high because there is no loss of base material being welded.

Rosemount's new division is headed by Leonard F. Akers, formerly with Airco and Aerojet- General Corp. Dr. Frank Werner is president of the four-year-old firm.

Turco produces film on dye penetrants

A full color and sound, 23 minute film titled "How to Locate Flaws with Dye Penetrants" has been produced by Turco Products, Inc., Wilmington, Calif.

The film is available for free showing to industrial concerns, technical groups and other interested organizations. It is intended primarily for training purposes and shows on-the-spot sequences of inspection of wing spars, small aircraft parts, truck wheels, valves, oil tool components, gears, spindles and pressure vessel weld seams.

COMING EVENTS

NOV. 28-29: NWSA Southeastern Zone meeting, Hillsboro Hotel, Tampa.

DEC. 1-2: NWSA Southwestern Zone meeting, Hotel Roosevelt, New Orleans.

DEC. 5-8: 1st Biennial Short Course on Welding Engineering, University of Illinois, Urbana, Ill.

JAN. 23-25, 1961: 12th Annual Plant Maintenance & Engineering Show, Palmer House and International Amphitheatre, Chicago.

MAR. 20-24, 1961: 12th Western Metal Congress, American Society of Metals, Pan-Pacific Auditorium, Los Angeles, Calif.

MAR. 24-25, 1961: Welding Show & Exhibit, Wichita Section AWS, Kansas National Guard Armory, Wichita, Kans.

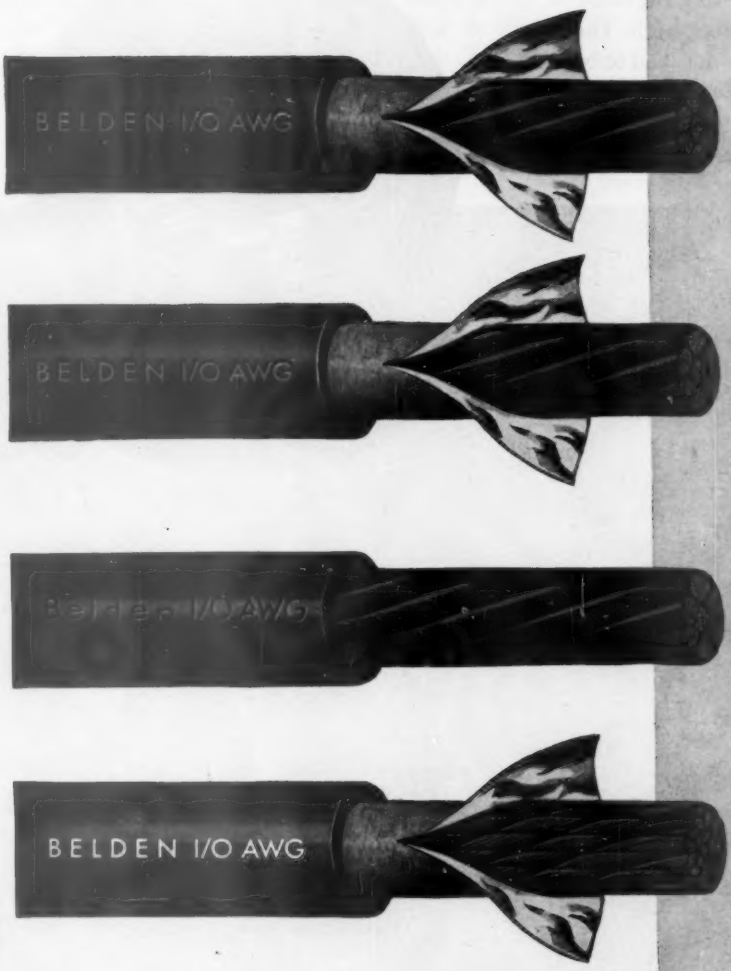
New method of grinding sheet edges developed

A new automatic method of grinding edges of flat sheets for resistance seam welding has been developed by National Electric Welding Machines Co., Bay City, Mich., in cooperation with engineers of Inland Steel Container Co., Chicago.

The developers say the method eliminates wheel dressing and readjustment of the grinding device and reduces frequency of replacement.

Utilizing an automatic container line built by National Electric for Inland, the new method employs a coated abrasive wheel to clean the edges of either hot or cold-rolled sheets. The firm's engineers report the flexible cloth wheel easily cleans hills and valleys in the sheet edges.

Belden Welding Cable
the Complete Line



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Whip Lead Cables
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How Charles Houston helped

When you're grinding weld beads, a yard can seem like a mile if you're stuck with a second-rate grinding wheel. The bigger the job, the more important it is to have highly efficient wheels.

On one particular job, in fact, at Arduini Manufacturing Company in Worcester, Mass., the dimensions alone were enough to give a portable grinder operator nightmares. It was an enclosure for a Westinghouse turbine generator 85 feet long and 20 feet high. The welds were exceedingly long and heavy and had to be finished with expert care for one important reason: The entire 3/16" steel structure was due for only a single coat of paint!

As operator Amos "Mickey" Recore said: "It was kind of like being a Hollywood make-up artist trying to make the heads on Mount Rushmore look like human skin. And, brother, it seemed like there was about five hundred acres of welds to grind."

Operator Amos Recore blends heavy weld bead on giant turbine generator enclosure using fast, reliable, Bay State Blue Flash hat wheel on high-speed, portable grinder. (Wheel guard has been removed for photography.)

Plant Superintendent Pierre Boutillette (right) and Grinding Department Foreman John Harrison (left) examine smooth, unblemished finish after weld bead has been ground with a Bay State Blue Flash hat wheel.

smooth "acres of welds" at Arduini Manufacturing Company

Thanks to Charles Houston, Jr., of Bay State distributor Industrial Supplies, Inc., Recore had Bay State Blue Flash wheels to work with, and the job was done without gouging, burning or undue strain of any kind. To quote operator Recore again, "those Blue Flash wheels are the best I ever used."

Between the well-known Blue Flash series and the new Koolie Hat wheels, Bay State has answers for just about every type of weld-grinding problem in the book. For these and also for problems that are *not* in the book, call your Bay State distributor or direct representative. Better grinding at lower cost . . . that is his business.

As V. P. and Sales Manager of Bay State distributor Industrial Supplies, Inc., Worcester, Mass., Charles J. Houston, Jr., has an enviable record of experience in almost every phase of metal-working. With a solid business-school background on top of that, his technical knowledge is thoroughly supported by training in the problems of management. In other words, he knows his job is to help *you* make a profit. This is typical of *all* Bay State representatives.

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✻ GLENN Balanced Wave Power Supply for TIG Welding ✻ GLENN Manual and Stud Welder Power Supply ✻ GLENN Arc Gouger Power Supply ✻ GLENN Constant Potential Welder for "Gang" Manual Welding ✻ GLENN Industrial Power Supplies and Heavy Duty Variable Voltage Transformers

3

WELDING ENGINEER

Your November, 1960

Weld World

As WE went to press, these were the industry's latest developments:

. . Birdsell Mfg. Co., Palo Alto, Calif., has been purchased by Computer Engineering Associates, Inc., Pasadena, Calif., a subsidiary of Susquehanna Corp., Chicago. Sales office of the welding machine manufacturer will be moved to Pasadena, with R. Gail Beckstrand as sales manager.

. . Anaconda American Brass Co. is the new name of The American Brass Co., Waterbury, Conn., one of the nation' largest producers of copper and brass mill products (which include welding alloys.) The firm is a wholly owned subsidiary of The Anaconda Co.

. . D. W. Onan & Sons, Inc., Minneapolis, manufacturer of electric generating plants, has been acquired by Studebaker-Packard Corp. It will be operated by its present management as a Studebaker division.

. . Steel production last month took a sizeable dip. As a whole, industry was operating at a little under 53% of capacity.

. . Despite a strike at a large Chilean mine, the custom smelter price of copper was cut 2 cents a pound--down to 31 cents. Ample supplies were cited as the reason. Prices are expected to dip even further.

. . Page Steel & Wire Div., American Chain & Cable Co., Monessen, Pa., is extending its color coding system to all cartons, spools and Pay-Off-Paks containing its automatic welding wires. Until now only cardboard liners or coils were so coded.

. . Crucible Steel Co. of America, through its subsidiary World Crucible Ltd., has purchased 75% ownership of the Fonderie Acciaierie Milanesi Vanzetti, S. p. A., Milan, Italy, European producer of specialty steels.

. . An "on-the-site" pipe-making machine was shown at the American Gas Association convention last month in Atlantic City. Demonstrated by Driam Corp., Manitowoc, Wis., the unit makes spiral pipe directly from coils of steel by means of submerged-arc, Tig or resistance welding. (More details on page 79 of this issue.)

. . Olin Mathieson Chemical Corp. has adapted the Mig arc spot process to aluminum. Although widely used on steel, the method heretofore has produced inconsistent results on aluminum. Some existing limitations: the Mig spot process is not currently applicable to material thinner than 0.030 in.; when different thicknesses are joined, welds must be made from the lighter gage material to the heavier; and these spot welds cannot yet be used to join high-strength, heat-treatable aluminum alloys in the 20XX and 70XX series.

Monautronic V-2 welding control certifies weld quality... cuts rejects and production costs

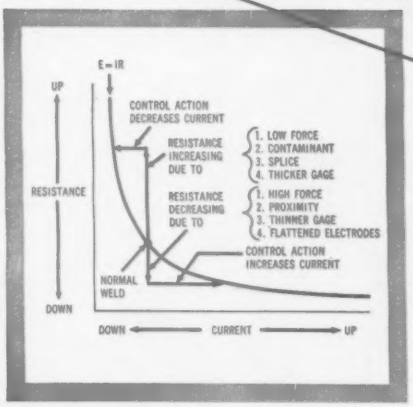
A resistance welding control that automatically compensates for every process variable

The new Monautronic V-2 welding control introduces the concept of feedback control to produce spot-welds of consistently high quality. It makes use of the latest advances in electronic computing to overcome automatically such obstacles to weld quality as line voltage fluctuation, electrode wear, variations in electrode tip force, surface finish and shunting.

The Monautronic V-2 compensates for undesirable variations usually encountered in resistance welding by maintaining voltage across a weld at a constant value. This constraint of voltage amounts to constraint of final weld temperatures, and such temperature control assures production of quality welds.

- **Automatic lockout**—occurs when process variations are so severe that the available current range would not cover the requirements for quality welding. The control detects extreme contamination, failure in the force system, overwelding, poor matching or fitup, and any other conditions that would result in substandard welds.
- **Automatic sequencing**—all provisions for single spot, roll spot or seam welding. Sequencing is 100% accurate, and exceeds NEMA standard specification 3B. Special sequence programming is available.
- **Transistorized design**—for high reliability, compactness, low power consumption.
- **Modular construction**—permits easy removal of the three modules and separate firing unit, simplifies maintenance.
- **Shock and vibration resistant construction**—for long, reliable service in even the most demanding applications.
- **Safety interlock**—for protection of personnel during tip dressing.
- **Tamperproof case**—prevents access to control by unauthorized personnel.

SEQUENCE MODULE—Utilizes digital pulse-type circuitry . . . provides 100% accuracy.
HEAT CONTROL MODULE—Contains automatic and manual heat controls plus lockout devices. Processes input information from weld.
POWER SUPPLY MODULE—Power supply plus required auxiliary safety features.
FIRING MODULE—Provides large currents needed to fire ignitrons. Supplied as separate module.



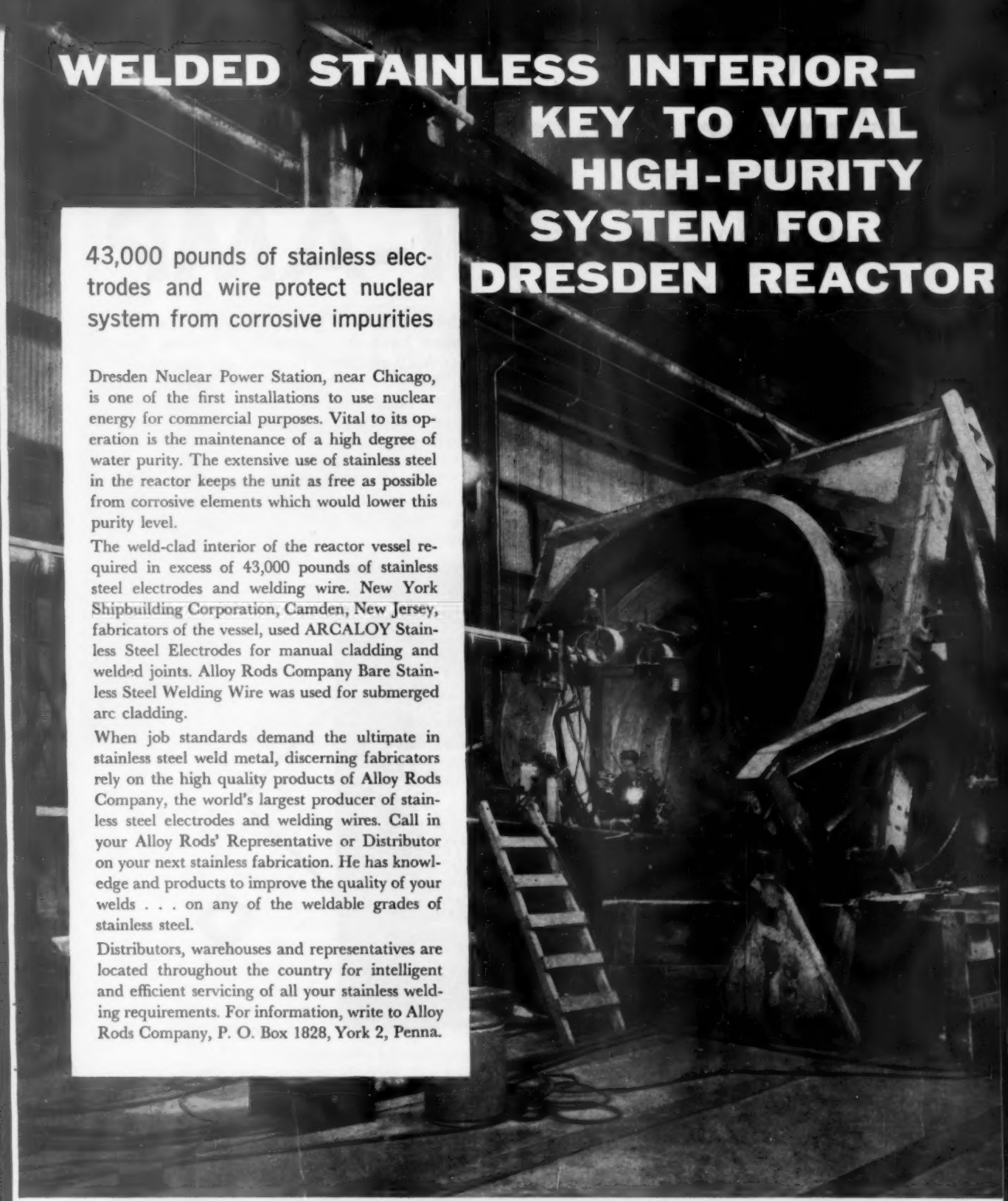
VOLTAGE CONSTRAINT

Graph shows how voltage control compensates for process variations. Any point on curved line E = IR represents a specific voltage. With normal weld as reference point, certain process variations cause increased resistance, while others cause a decrease. Control action is achieved through change of current to constrain voltage to same level for every weld.

for complete details contact: THE BUDD COMPANY
Electronic Controls Section • Philadelphia 32, Pa.

ELECTRONIC Budd CONTROLS

WELDED STAINLESS INTERIOR— KEY TO VITAL HIGH-PURITY SYSTEM FOR DRESDEN REACTOR



43,000 pounds of stainless electrodes and wire protect nuclear system from corrosive impurities

Dresden Nuclear Power Station, near Chicago, is one of the first installations to use nuclear energy for commercial purposes. Vital to its operation is the maintenance of a high degree of water purity. The extensive use of stainless steel in the reactor keeps the unit as free as possible from corrosive elements which would lower this purity level.

The weld-clad interior of the reactor vessel required in excess of 43,000 pounds of stainless steel electrodes and welding wire. New York Shipbuilding Corporation, Camden, New Jersey, fabricators of the vessel, used ARCALOY Stainless Steel Electrodes for manual cladding and welded joints. Alloy Rods Company Bare Stainless Steel Welding Wire was used for submerged arc cladding.

When job standards demand the ultimate in stainless steel weld metal, discerning fabricators rely on the high quality products of Alloy Rods Company, the world's largest producer of stainless steel electrodes and welding wires. Call in your Alloy Rods' Representative or Distributor on your next stainless fabrication. He has knowledge and products to improve the quality of your welds . . . on any of the weldable grades of stainless steel.

Distributors, warehouses and representatives are located throughout the country for intelligent and efficient servicing of all your stainless welding requirements. For information, write to Alloy Rods Company, P. O. Box 1828, York 2, Penna.

ALLOY RODS COMPANY

YORK, PENNSYLVANIA

SALES OFFICES & WAREHOUSES; BOSTON, NEWARK, PHILADELPHIA, PITTSBURGH, BIRMINGHAM, CHICAGO, SAN FRANCISCO & EL SEGUNDO, CALIF.—DISTRIBUTORS IN ALL OTHER PRINCIPAL CITIES

TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

For more facts Circle No. 159 on Reader Service Card

Having Welding Troubles?

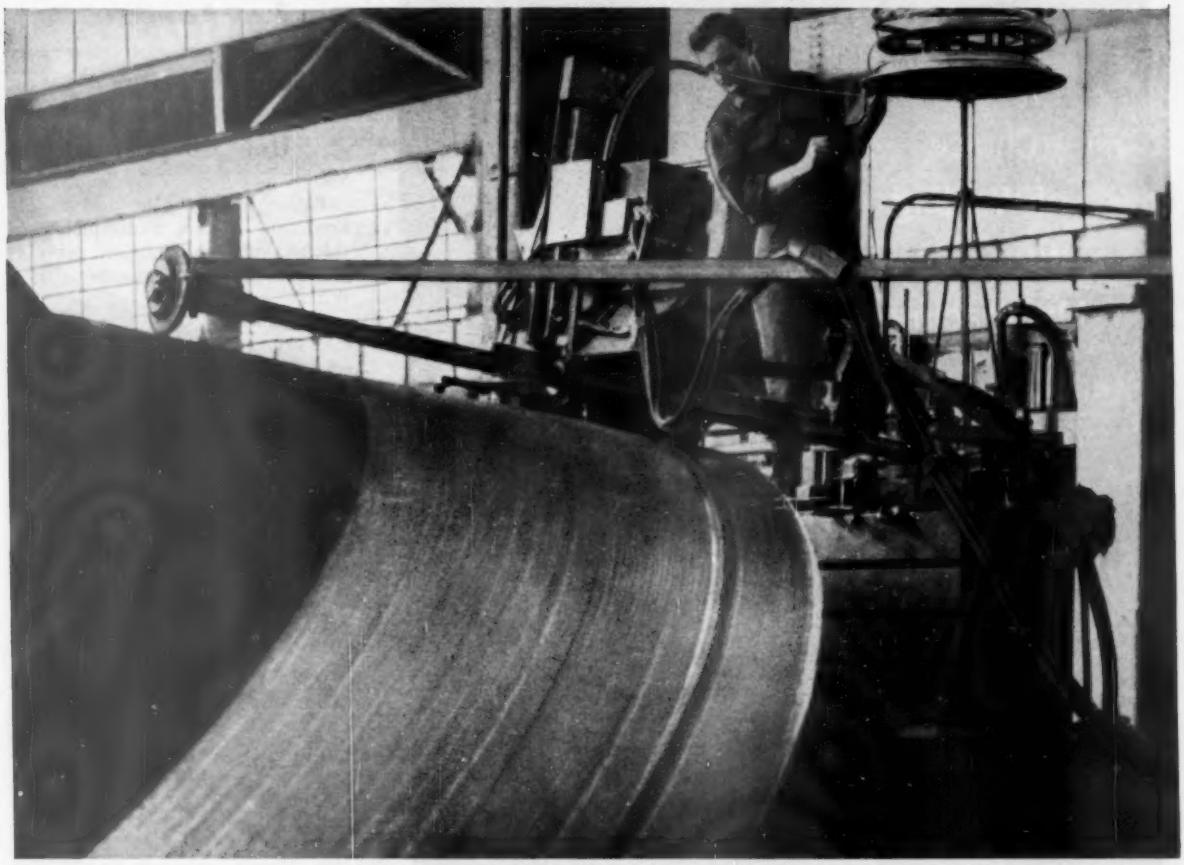
ASK FOR TROUBLE FREE HI-AMP

Profit-conscious companies from coast to coast have discovered that trouble free **HI-AMP** electrode holders and accessories cost them less, while serving them better. Many purchasing agents have effected annual reductions which are substantial by switching to **HI-AMP**. Your distributor will demonstrate how **HI-AMP's** cool, trouble free operation will enable you to buy more suitably, as well as economically. See your **HI-AMP** distributor without delay.

Insist On HI-AMP Accessories From Your Welding Supply Distributor

LENCO, Inc. JACKSON, MO.

METALS LIVE LONGER...WHEN HARD-FACED WITH "HAYNES" ALLOYS



Submerged-arc welding equipment here deposits HAYNES hard-facing alloys on large areas of a 15-foot diameter blast furnace bell, to resist abrasion, impact, erosion.

Hard-Facing BIG Areas . . . Rapidly

Many big jobs are now being hard-faced with standard submerged metallic-arc equipment—using HAYNES alloys. The advantages: high rate of deposition, up to 20 pounds per hour; large cross sections faced without pre-heating; minimum deposit dilution by use of multiple layers.

For hard-facing gyratory crushers, blast furnace bells and hoppers, crusher rolls and jaws, tractor rollers—wherever impact, abrasion, heat, corrosion, erosion are problems—HAYNES alloys in drawn-tube rod form give the desired properties. They feed smoothly and uniformly.

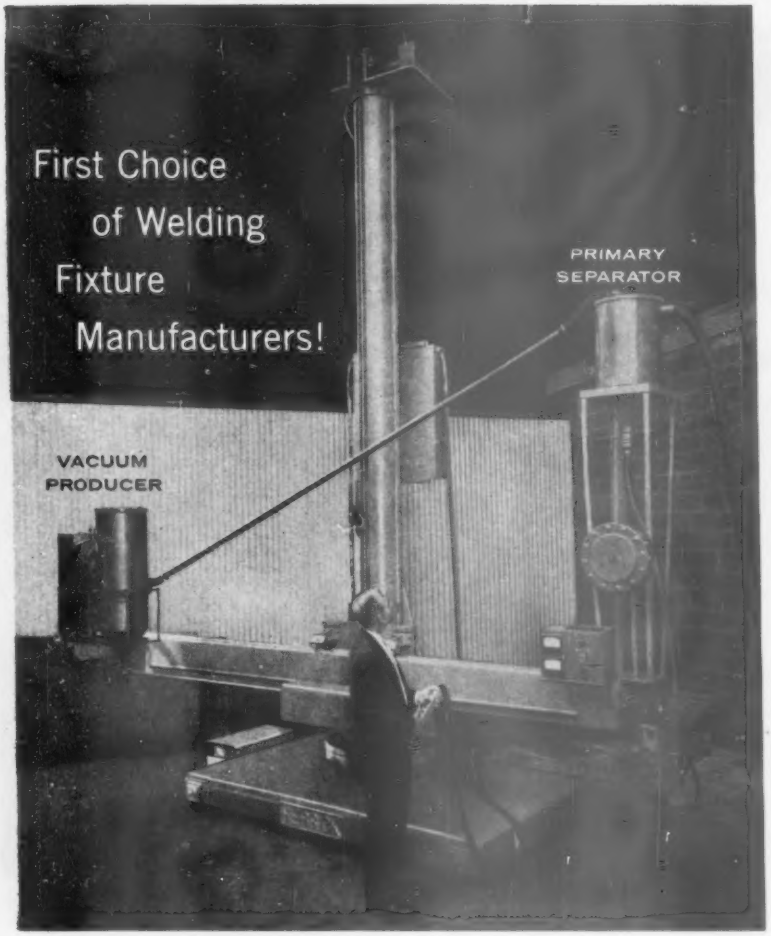
Many smaller-area hard-facing jobs, too, are being done faster and at lower cost, on a production-line basis. Whether you hard-face large areas or small—whatever your hard-facing job is—it will pay you to insist on HAYNES rods. Our field engineers will gladly help you solve your hard-facing problems. Write us today!

HAYNES
ALLOYS
HAYNES STELLITE COMPANY
Division of Union Carbide Corporation
Kokomo, Indiana

UNION CARBIDE

Address inquiries to Haynes Stellite Company, 270 Park Avenue, New York 17, N. Y.

"Haynes" and "Union Carbide" are registered trade marks of Union Carbide Corporation.



INVINCIBLE UNITS

Automatically Reclaim Flux

This automatic ram type manipulator made by C. B. Herrick Manufacturing Corp., Cleveland, is used for welding steel plate bridge girders. Mounted on the carriage, an Invincible Flux Recovery Unit travels with the welder along the full length (up to 130 feet) of the girder. It recovers all unfused flux . . . removes powder . . . and returns slag-free, dust-free flux to the welder automatically, in a continuous flow.

Fixture manufacturers—and users—specify Invincibles because they are engineered specially for handling abrasive materials and for continuous operation. Their rugged construction assures years of full-time operation—no loss of production time.

Savings in reclaimed flux alone pay their cost in a few months, even weeks. In addition, Invincibles save costly man-hours over manual methods, speed-up production, minimize rejects.

In 14 standard automatic and manual models (1½ to 7½ H.P.). Accurate free surveys of your submerged arc welding operations can be made on short notice. Resident engineers in all principal cities.

Send for Invincible Flux Recovery Equipment Folder.

INVINCIBLE VACUUM CLEANER MFG. CO.
DOVER, OHIO

Letters...

Uni-Con process

Sir: *Portland, Ore.*

Please send me the address of Fred and Theron Federspiel, developers of the Uni-Con process featured in your September 1960 *WE*.

I commend you on your scholarship article also in the September issue. Being an instructor in welding, this particular article is one that thoroughly expresses my opinion on this matter.

John E. Ugar

Sir: *Macon, Ga.*

I have read with interest your article *Welding and concrete team up to construct Florida's newest home building entry* in the September 1960 issue.

Could you please send me any information on this type of construction. If this is not possible, could you please send me the name and address of the company that can supply me with additional details.

Willie L. Poole

Sir: *Visalia, Calif.*

Will you please send an address where I might contact Fred and Theron Federspiel in Florida.

John E. Trask
Visalia Welding Works

(Welded houses continue to attract attention. WELDING ENGINEER *has probably received more mail on its articles on welded homes than any other type of non-technical story. The address of Theron R. Federspiel is* 1818 *Indian Rocks Rd., Largo, Fla. — Ed.)*

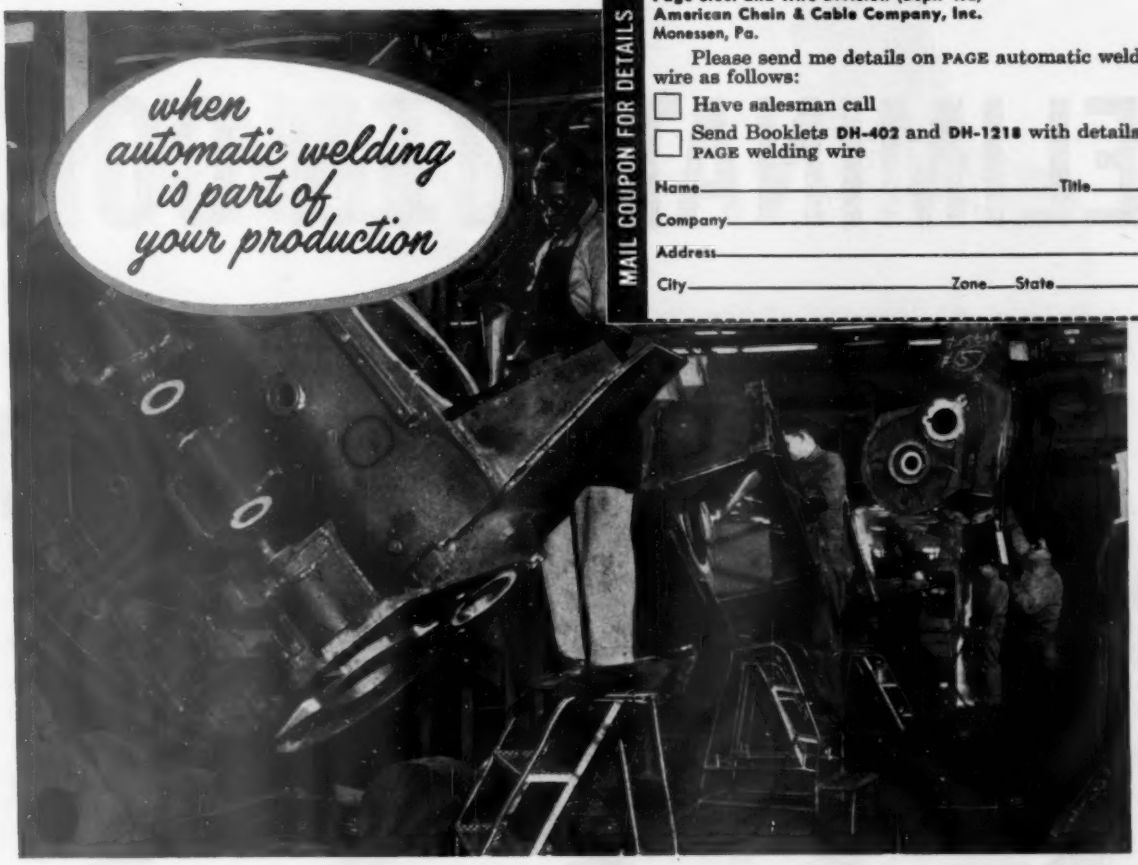
Pipeline welding

Sir: *Minden, La.*

Enjoyed your October special issue on pipeline welding. May I add a few comments.

Pipeline welding can be fun as any pipeline weldor can tell you . . . provided, of course, you don't mind the dirt, dust, lousy working conditions, poor fit-ups, warm drinking water, long hours and short pay. To a real lover of pipe

(Continued on page 22)



MAIL COUPON FOR DETAILS

Page Steel and Wire Division (Dept. WE)
American Chain & Cable Company, Inc.
Monessen, Pa.

Please send me details on PAGE automatic welding wire as follows:

☐ Have salesman call

☐ Send Booklets **DH-402** and **DH-1218** with details on PAGE welding wire

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

ONLY PAGE OFFERS ALL THESE ADVANTAGES!

The wire that meets your production needs • Good automatic welding demands these two wire qualities: a wire analysis which gives the best match to the metals to be welded, and wire uniformity. You get both when you use PAGE welding wire. From a full 33 analyses—the largest selection available from any manufacturer—PAGE can supply the right wire for *your* welding job. We also can develop *special* wires for particularly tough welding operations. And regardless of the wire that's best for you, you can count on PAGE uniformity—consistent, metallurgical quality, accurate size, proper finish.

Coil identification to speed up production • Liner markings on each coil of PAGE welding wire provide positive identification, end mix-ups. And on #2 coils, liners are color-coded as well. The color of the stripe indicates the grade, makes identification double-quick and fool-proof.

Packaging that keeps production flowing smoothly • PAGE supplies welding wire in every form of packaging for modern production methods. You can specify PAGE wire in 25 lb. coils or reels—on up to 1200 lb. Payoff-pallets. Special packaging available when required.

GET THE COMPLETE STORY!

Mail the coupon at top—or write us describing your welding requirements. We'll be glad to help you select the right welding wire analysis and packaging for your operation.

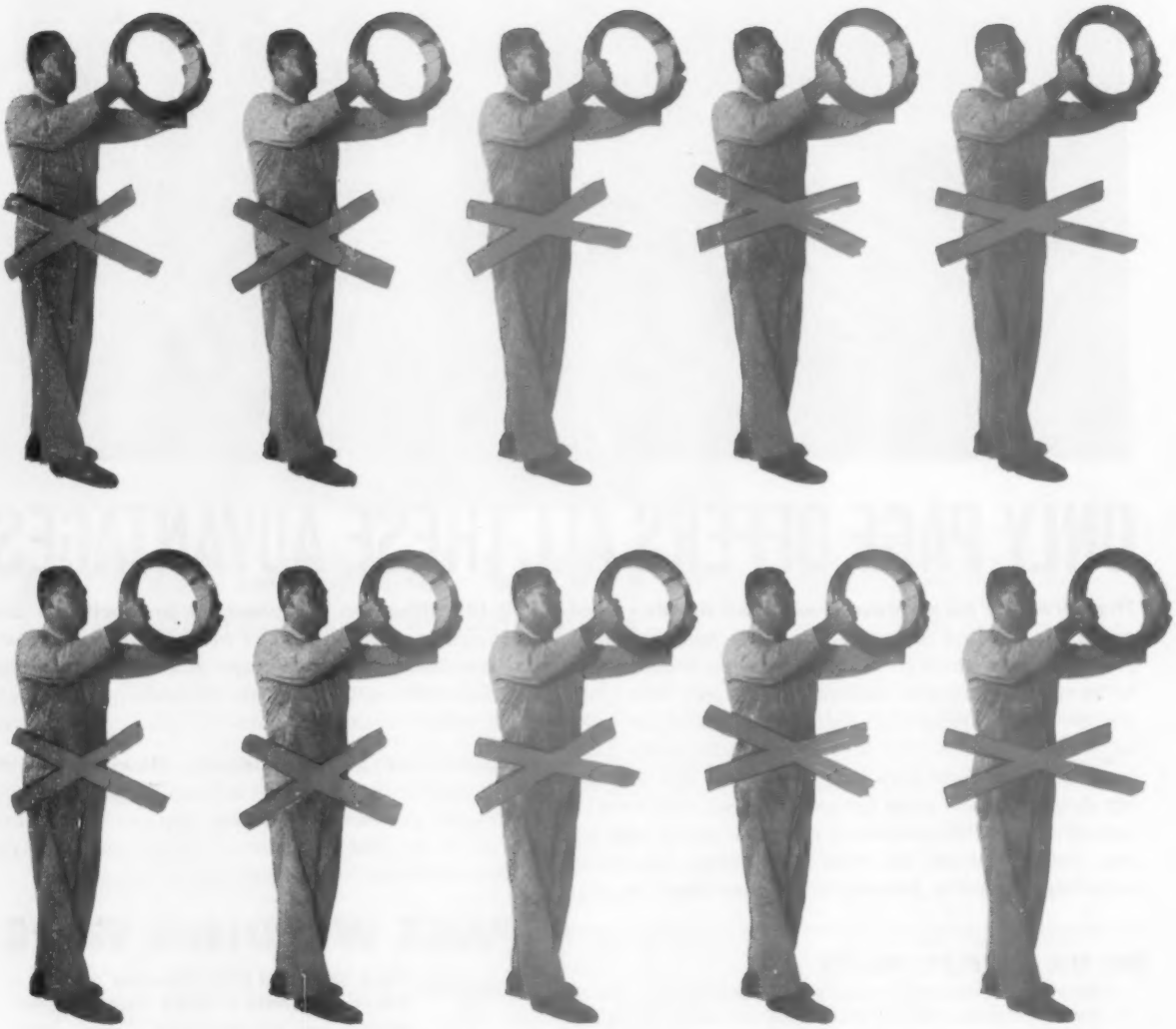
PAGE WELDING WIRE

ACCO

Page Steel and Wire Division
American Chain & Cable Company, Inc.
Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*, New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.
**Indicates PAGE warehouse stocks*

PAGE —the source for answers to welding problems

ELIMINATE TEN COIL



CHANGES

You save time, space and money with PAY-OFF-PAK drums of Lukens Plate-Mate Welding Wire.

You save ½ cent a pound by purchasing welding wire in 700-pound PAY-OFF-PAKS. You save 43% storage space compared with coils. You save downtime by eliminating ten coil changes . . . 2¾ to 5½ hours that could be put to profitable production. You save power—with accessories, PAY-OFF-PAKS can be turned with no more power than it takes to turn a 60-pound coil. And PAY-OFF-PAKS protect the wire from dust, dirt and damage. Available for all diameters up to 7/32".

PAY-OFF-PAK ACCESSORIES

HAND TRUCK—Where an overhead crane is not available, a Plate-Mate hand truck will speed stock arrangement and replacement.

GRAB—Handy drum grab quickly and reliably grips the strong fiber drum, permits sure, fast movement by crane.

TURNTABLE—Plate-Mate turntable feeds the continuous wire dependably and easily through a stationary eyelet. Ball-bearing base.

LUKENS STEEL COMPANY, Coatesville, Pa.

LUKENS PLATE MATE

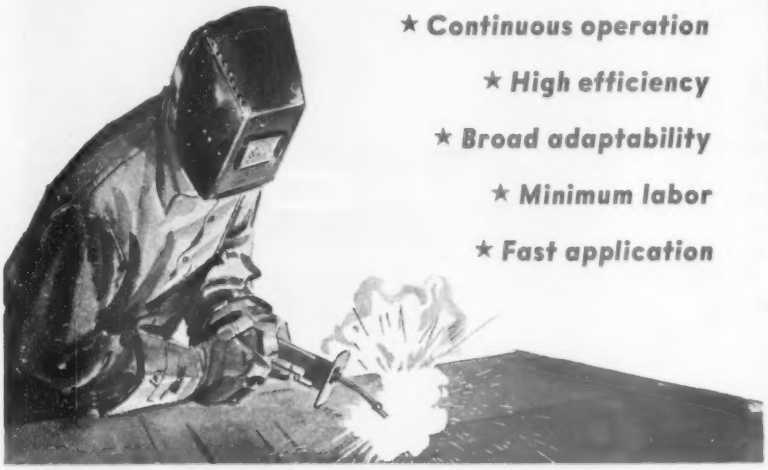
For more facts Circle No. 164 on Reader Service Card

NOW IT'S READY!

New **Ranomatic** *Wire*

For Automatic and Semi-Automatic Hardsurface Welding

RANITE manual rod quality now available in tubular coil wire for automatic and semi-automatic hardsurface welding



★ *Continuous operation*

★ *High efficiency*

★ *Broad adaptability*

★ *Minimum labor*

★ *Fast application*

RANOMATIC will be sold through your local **RANITE** distributor. For detailed information and prices ask him for bulletin No. R101, or write direct to Rankin Manufacturing Company.

RANKIN MANUFACTURING COMPANY

616 S. MARENGO AVE. P. O. BOX 631 ALHAMBRA, CALIF.

welding, however, these are nothing when you really love to weld pipe.

Follow these simple rules:

1. Be sure the machines, rods and holders are the kind you like. If the spread boss doesn't have them, wait till he gets them.

2. Insist on dry, cool days to do the welding. There is plenty of time so rest on days when there is mud and water.

3. Insist on mild steel pipe at all times. Other pipe is merely tough to handle, results in poor welds and besides, it costs more money.

4. Other little things that can make the job easy are, cold beer, a rubber mattress and two helpers for each weldor.

Yes, pipe welding can be fun, but as far as I'm concerned, it will never replace rubber hose couplings. Yours for more fun in welding.

Ralph A. Westling

Career film

Sir: *Milwaukee, Wisc.*

A career film such as referred to on page 37 of your August 1960 issue [*Training of welding technicians must increase to meet demands*] will soon be available from AWS.

This is a 15 minute kinescope of a TV program originally broadcast over WMVS in Milwaukee.

William Zimmerman
Milwaukee Section AWS

Congratulations

Sir: *Middletown, Ohio*

I have been reviewing the copy of WELDING ENGINEER, August, 1960 and wish to congratulate you upon the fine presentation of items of general interest.

Of course, there was one piece of particular interest to me and that was on page 63, *Table of estimating costs for manual oxyacetylene welding*. Such charts are of great use to me.

C. B. Trueblood
Senior Sales Engineer
Welded Pipe Sales

Letters should be addressed to: The Editor, The Welding Engineer, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

EASY-TO-USE Inco-Hard "1" Electrode proved an effective way to extend the service life of the mild steel table flange on this machine used for blast cleaning. Welding with Inco-Hard "1" requires no special techniques. Deposits seldom require grinding.

Four extra months of service with Inco-Hard "1" overlays on abraded surfaces

High velocity steel shot, used in this blast-cleaning machine, abraded the mild steel table flange into uselessness within 6 to 8 months.

The wearing-down process takes place at a much slower pace now. After 10 months of continuous service, the surfaces, overlaid with Inco-Hard* "1" Electrode, show little sign of wear.

The Kausel Foundry Co., Minneapolis, Minn., used Inco-Hard "1" in two passes to build up the worn flange. Test results of overlays on mild steels indicate that the weld-metal surface hardness ranges from 650-700 Brinell for two-layer deposits, about 500 Brinell for one-layer deposits.

Besides these high hardnesses and excellent resistance to abrasion, Inco-Hard "1" welds are easy to make.

There are no special techniques to learn. With AC or DC, you get a stable, spray-type arc in all positions. You have a minimum of spatter and other benefits...high deposition rate, good slag removal and excellent control over bead contour.

Get more of the story. You'll find it in our 6-page booklet, *"New Inco-Hard "1" Electrode for Hard-Surfacing..."* It's yours on request. Send for a copy.

*Inco Trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17, West Virginia

INCO WELDING PRODUCTS
TRADE MARK
ELECTRODES · WIRES · FLUXES

For more facts Circle No. 166 on Reader Service Card

1916 45th ANNIVERSARY 1961

In January 1961, WELDING ENGINEER celebrates 45 years of service to the Welding Industry. Thru Two World Wars, A Great Depression, and Boom Years—WELDING ENGINEER has held its place as the NO. 1 REPORTER to the ever expanding Welding Industry.

WELDING ENGINEER Magazine

1961 **1ST.** 1961

IN READER PREFERENCE
IN EDITORIAL EXCELLENCE
IN READER SERVICE
IN WELDING INDUSTRY PROMOTION

SPECIAL JANUARY ANNIVERSARY ISSUE

CLOSING DATE DEC. 1, 1960

READERS OF THE BIG JANUARY ANNIVERSARY ISSUE WILL KEEP IT AS A REAL TREASURE FOR IT WILL BE A TEXTBOOK OF THE BASIC WELDING PROCESSES. COVERING ALL OF THE BASIC FORMS OF WELDING AND CUTTING OF METALS, THIS ISSUE WILL BE JAM PACKED WITH WELDING KNOWLEDGE FOR ALL INDUSTRY.

To get your sales message to more than 25,000 of the most important men in the Welding Industry, act now to reserve space in the great 45th ANNIVERSARY ISSUE.

WELDING ENGINEER
Box 28
Morton Grove, Ill.

TO ALL MANUFACTURERS
OF WELDING EQUIPMENT – –

The Welding Engineer goes to more men who specify the brand of equipment, more men who have the authority to BUY, than any other welding publication. If you haven't seen them write us now for copies of No. 1, 2, 3 and 4 Reports on our Welding Industry Purchasing Studies. A factual survey of the Metal Working Industry. This information has never been available to manufacturers before.

Write TODAY. *Reports available to manufacturers only.*

Between passes

co-op student

Ohio State University's first welding engineer cooperative student is Charles Wilson, who enrolled at the school this past September. He is an employee of the Portsmouth Naval Shipyard.

Wilson will study the five-year curriculum which will result in a bachelor of science degree in welding engineering. The U. S. Navy, through the Portsmouth yard, will be his employer during these five years. He will be on leave status to attend school nine months of each year. The Navy will pay part of his expenses as well as his salary while he works during the summer months at the shipyard. Wilson is from Greensboro, Vt.

If you know of any high school graduates who might be interested in this welding engineering co-op program, have them write the Industrial Relations Dept., Portsmouth Naval Shipyard, Portsmouth, New Hampshire.

Programs like this one – added to the various scholarships recently instituted in welding engineering – should insure a greater number of graduate engineers who will devote themselves to the welding industry.

CO-OP student in welding engineering at Ohio State, Charles Wilson (center) discusses some of the welding problems encountered on the USS Thresher, lead ship of the world's most advanced class of nuclear attack submarines. Wilson is an employee of the Portsmouth Naval Shipyard. At left is Stanley I. Roberts, welding engineer; at right is Raymond Rivers, training supervisor.

plasma underwater

When the plasma arc first made its appearance on the industrial scene, the number of potential applications claimed for it was astounding. But, in truth, a great number of these have been realized.

Plasmadyne Corp., which manufactures Plasmatron spray coating equipment, reports that it has successfully cut through a series of metal plates submerged in water within a matter of seconds using a hand held plasma jet spray gun.

Use of noble gases as the plasma mediums allows cutting under water without danger of contamination of either the water or the metallic surface. Arc temperatures reached in these experiments under water were from three to five times that achieved by an oxyacetylene torch. Hence, the technique is applicable for use in areas where rapid cutting is required or where toxic materials must be cut.

from overseas

Another recent returnee to this continent from Europe is R. M. Gooderham, manager of the Canadian Welding Bureau. He was Canada's chief delegate to the Congress of the International Institute of Welding in Belgium. While overseas, he presented a paper (in conjunction with Dean Wright of Waterloo University) on structural welding in Canada before the International Association of Bridge and Structural Engineering in Stockholm.

He also visited Moscow during an extensive exhibit of welding equipment and processes.

Gooderham made particular studies of European methods of education for welding at all levels from the operator to the engineer. He is presently preparing a report and a series of lectures on his experiences overseas.

How long have you been reading WE?

We are searching for a subscriber — the subscriber who has been receiving WELDING ENGINEER longer than anyone else.

In conjunction with our 45th anniversary, which will be marked with the January issue and which will be celebrated throughout 1961, we hope to give public recognition to the reader who has been our most faithful adherent.

If you have been subscribing continuously for many years, please send your name, address and the date you first became a subscriber to: The Editor, WELDING ENGINEER, Box 28, Morton Grove, Ill.

We hope to announce the name of our senior subscriber in the special January issue that will commemorate our 45th year.

To learn how an Aardvark licks termites... call in a *ZOOLOGIST*

(specialist on animals)

A native of Africa, the AARDVARK is a large, nocturnal, burrowing mammal subsisting largely on termites and has a long extensile tongue for gathering them. He has heavy claws for ripping open rotten logs to find more termites.

To learn how to lick welding problems... call in *LINCOLN*

(specialists in arc welding)

A VIRGINIA manufacturer of underground gasoline storage tanks needed to cut his welding costs . . . his highly competitive industry being plagued with low profits.

Although they were already using the LINCOLN automatic submerged arc process, the LINCOLN Field Engineer was able to show this company how to eliminate 25% of their welding labor. He switched them to the new LINCOLN vapor shielded INNERSHIELD process.

Now the 4000-gallon tanks, fabricated from ¾" steel, are welded at 90 inches per minute . . . with three men doing the job formerly done by four. Thus, reduced labor costs have substantially increased the profit margin.

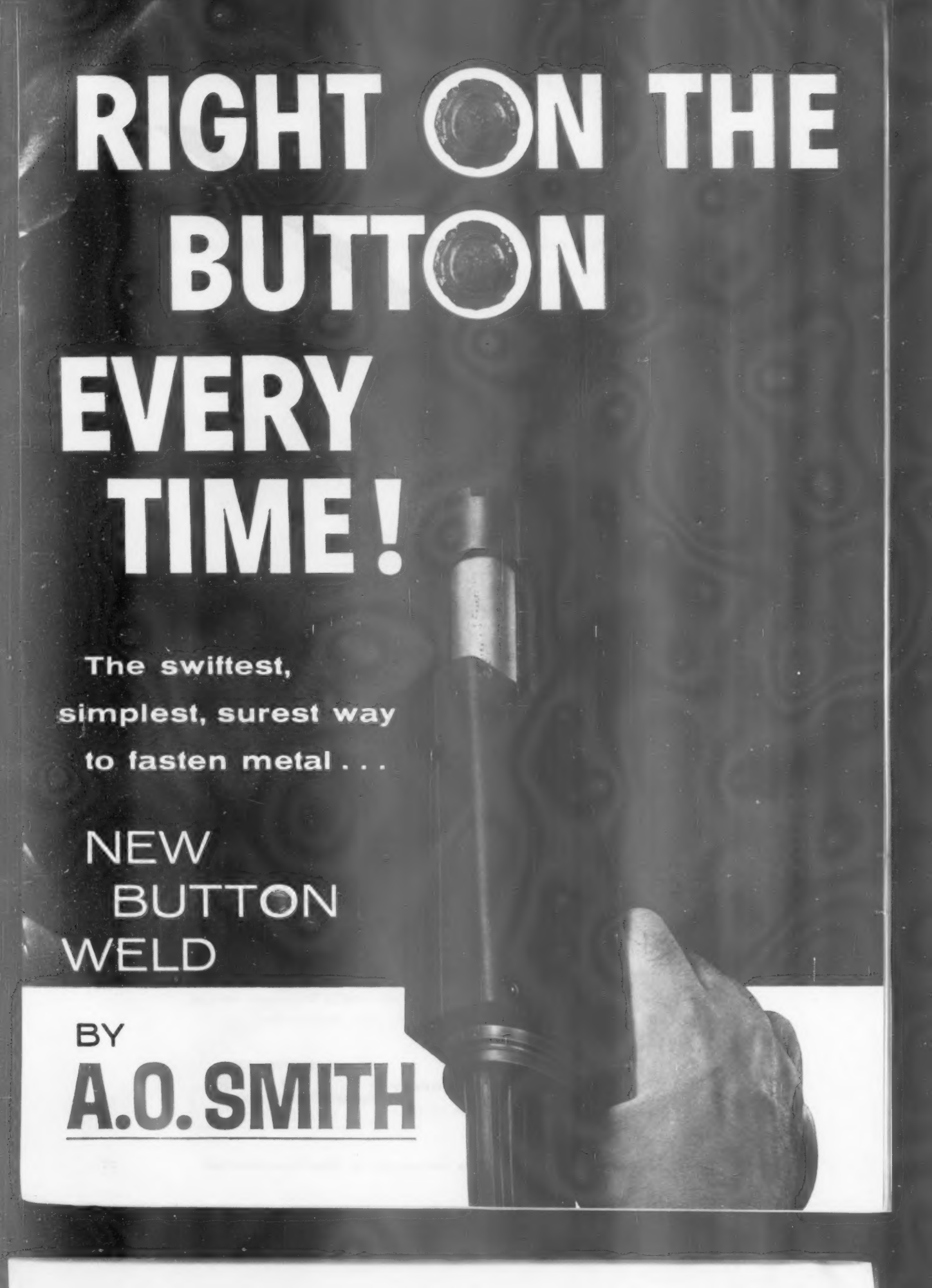
In addition, when this manufacturer licks a rolling and fit-up bottleneck, the three weldors will be able to almost double their present output with no additional help.

That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

THE LINCOLN ELECTRIC COMPANY
Dept. 1490 • Cleveland 17, Ohio

LINCOLN WELDERS

For more facts Circle No. 168 on Reader Service Card

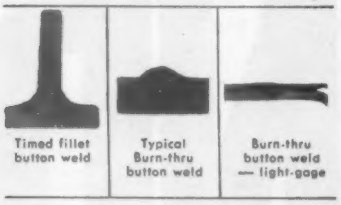

RIGHT ON THE BUTTON
EVERY TIME!
The swiftest, simplest, surest way to fasten metal . . .
NEW BUTTON WELD
BY
A.O. SMITH

C-OMANUAL button welding boosts output . . . cuts rejects

Here's one button the zipper hasn't replaced. In fact, this button process is the latest development in welding — a development that has replaced old-fashioned spot-resistance welding and riveting.

Armed with a lightweight hand gun using A. O. Smith's CO_2 C-OMANUAL process, the operator works from one side only. The button burns through to fasten steel up to 3/16 in the downhand position and 3/64 in the vertical. And welders take their helmets off to button welding — no need to wear one with this A. O. Smith process. Simple, too! Special operator training is not required. Just place the gun . . . pull the trigger! Hold until the welding stops *automatically*. Perfect button weld every time . . . no flux to clean.

Choice of nozzles permits welding of any of the standard joints (lap, fillet, butt).



Timed fillet button weld | Typical Burn-thru button weld | Burn-thru button weld — light-gage

Other button blessings include quality low-hydrogen weld metal, high deposition rates, full utilization of weld metal for low overall costs. Put this high-speed production tool to work for you. Send for Bulletin MW-253 for details.

Through research ... *a better way*

A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
A.O.Smith INTERNATIONAL S.A., Milwaukee 1, Wis. U.S.A.
Circle No. 169 on Reader Service Card

30 YEARS AGO

(Taken from **WELDING ENGINEER** of November, 1930)

W. D. Flannery of K-G Welding and Cutting Co., New York City, was elected president of the International Acetylene Association at that group's 31st annual convention held in Chicago.

—30 Years Ago—

R. D. Thomas Co., Philadelphia, distributor of arc-welding equipment and supplies, has moved its office and warehouse from Delaware Ave. and South St. to the Terminal Commerce Bldg., 401 N. Broad St.

—30 Years Ago—

W. S. Stewart has been promoted to district manager in charge of the Cleveland territory for the Lincoln Electric Co. He was formerly in charge of the Pacific Coast office.

—30 Years Ago—

In a reorganization move, Hobart Bros. Co., Troy, Ohio, has placed H. K. Miller in charge of its sales and service in Chicago, with offices at 3104 S. Michigan Ave. Miller is also connected with the Miller Bros. firm, 1835 N. Third St., Milwaukee, a Hobart distributor.

—30 Years Ago—

R. A. Vaughan, organizer and manager of Welders Supply Co., 333 Sixth St., NW, Canton, Ohio, reports a noticeable pick-up in business conditions in his area.

—30 Years Ago—

Earl Evleth has succeeded C. T. Price as commissioner and secretary of the Gas Products Association. Mrs. Kathryn Mims has been appointed secretary and A. C. Krein treasurer. The association recently moved its offices from 608 S. Dearborn St., Chicago, to 240 E. Ontario St., in that city.

—30 Years Ago—

A record number of welding equipment and alloy manufacturers exhibited at the International Petroleum Exposition held in Tulsa. Among the familiar names were Lincoln, Stoody, Burdett, Victor, Union Carbide, Fusion, Shrader, Air Reduction, Modern Engineering, Shawinigan, Page, Tube Turns and A. O. Smith.

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Tempilstik°—a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Widely used in all heat treating—as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings from 113°F to 2500°F . . . $2.00 each.

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UNIONARC

REDESIGNED...REBUILT...RELIABLE

Development of a LINDE welding process does not stop with its introduction. In the past 18 months, we have invested over 3000 laboratory manhours to further improve the UNIONARC welding process and equipment. New: portable UAM-2 machine, simplified UAW-2 torch, refined consumables. Improved equipment for an improved CO_2 steel welding process, featuring

- **...wear-resistant flux and wire-guide tubes, super-hard "Stellite" torch body**
- **...automatic flux-CO_2 shutoff valve for precise flow of consumables**
- **...stainless-steel hopper funnel for smooth flux feed**
- **...serrated V-groove drive roll (patent pending) for positive wire feed**
- **...miniature machine—300 lbs. lighter, uses 50% less space**
- **...refined flux that increases metal deposition rates**
- **...proven results: dependable operation with minimum maintenance.**

For field-tested application details, see next page

UNIONARC

Portable machine . . . **produces 30-ipm . . .** **top-quality welds**

One of the nation's largest construction-equipment manufacturers field-tested 15 UNIONARC UAM-2 machines full time—three shifts a day, six days a week—over 2000 hours per week. Maintenance has averaged less than ½ hour per machine per week, a downtime factor of less than 0.5 per cent. This is tested reliability that insures process advantages:

- . . . cost as low as 27¢/lb. of metal deposited
- . . . deposition rates as high as 25 lb./hour
- . . . speed over 30 ipm on ¼ in. carbon-steel fillets
- . . . quality to strictest specifications—ASME, Military, Bureau of Shipping
- . . . full penetration requiring less preparation, fewer passes, less wire.

On a production basis, these advantages mean substantial savings. A western pipe manufacturer saved 25¢/ft. of weld on 28,000 feet of welds. A southwestern fabricator reduced welding time on three on-site storage tanks (9500 ft. of welds) from 1850 manhours to only 700 manhours. A northern manufacturer eliminated expensive reworking of code assemblies, gained 100% weld acceptance with UNIONARC compared to 50% to 90% with covered electrodes. A mid-western manufacturer eliminated beveling, and reduced pass and wire requirements on Schedule 40 pipe by 2:1 and 8:1 ratios respectively.

UNIONARC welding is an ideal process for carbon steel. On a production basis, it is unquestionably faster and more economical than other CO_2 or covered electrode processes. It uses a wide range of readily-available, low-cost wires that meet any application need. It uses one flux, one low-cost CO_2 shielding gas. It has the speed and weld quality of manual submerged-arc welding, with the advantage of weld visibility. It is a sound, well-engineered process designed primarily for repetitive, high-production work on carbon steel. For these applications, the new UNIONARC UAM-2 machine offers outstanding cost advantages with a field-proven low-maintenance factor that produces clear-cut profit for its user. For detailed information or a live demonstration, call your nearest LINDE office.

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UNION CARBIDE
Division of Union Carbide Corporation
270 Park Avenue, New York 17, N.Y.

NOVEMBER, 1960

Welding Engineer

ESTABLISHED 1916

Industry's apathy

WE DO NOT BELIEVE that those making their livelihood from welding are content with their present volume of business or net profits. Hence, we cannot understand their apathy in promoting the use of welding.

In our more than 20-year association with WELDING ENGINEER, manufacturers have always complained that they do not obtain properly trained engineering graduates, insofar as welding background is concerned.

Much of this fault lies with the complainers.

More than a year ago, we suggested they write the Engineering Council for Professional Development, detailing the curriculum they felt necessary to provide properly trained future engineers. It would be interesting to know how many did so.

Some members of the ECPD engineering school accreditation committee appear to be slightly short-sighted in their thinking. They are continually advocating the elimination of shop courses, such as machine shop and welding.

We assume they want this additional time for more theoretical and/or liberal arts courses. All well and good — the engineer should be broad in his knowledge.

But why eliminate courses which will give the engineering student the basic knowledge he will need in his career? Instead, why not lengthen the engineering curriculum to five years so both types of courses can be included? Thus equipped with both theory and practice, the young engineer would enter industry with a fuller knowledge of his field.

The engineering graduate who does not know a drill from a lathe, or the most practical means of joining materials, is of little value to his employer until such training is acquired.

Is he supposed to get it in school or in your shop? The employers must make the decision. If they want them trained in school, they had better act now by writing ECPD at 25 W. 39th St., New York 18, N. Y.

VICTOR

New gaugeless regulators

Available in VGS Single-Stage or VGT Two-Stage Models

1. Delivery pressure adjustment
- —Simple and easy to adjust
- —Readable on two sides
- —Bold pressure readings stamped in cap
- —Bright, easy-to-read pressure indicator

2. Inlet pressure indicator
- —Enclosed and protected piston-type
- —Clearly marked Full to Empty scale stamped permanently into metal
- —Reliable 'O' Ring Seal

3. Listed under Reexamination Service of Underwriters' Laboratories, Inc.

The VGS400 series single-stage and VGT400 series two-stage regulators embody all of the time-tested and field-proved design characteristics that have made VICTOR Safety Regulators the choice of the man on the job. The use of pressure indicators instead of pressure gauges provides increased service for hard usage applications. Order from your Victor dealer.

Single-Stage Models		Two-stage Models	
VGS430-967	0-100 psig	VGT430-967	0-100 psig
VGS410-970	0-15 psig	VGT410-970	0-15 psig

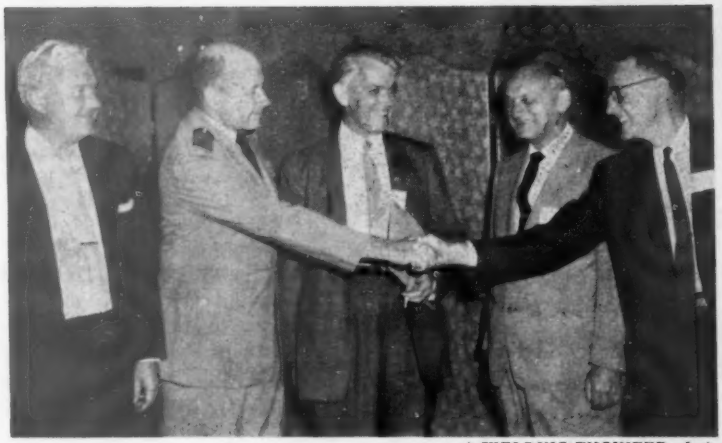
72

VICTOR for regulators

VICTOR EQUIPMENT COMPANY *San Francisco, California Los Angeles, California, Chicago, Illinois*

MFRS. OF HIGH PRESSURE AND LARGE VOLUME GAS REGULATORS; WELDING & CUTTING EQUIPMENT; HARDFACING RODS; BLASTING NOZZLES; COBALT & TUNGSTEN CASTINGS; STRAIGHT-LINE AND SHAPE CUTTING MACHINES; ROLLER AND IDLER REBUILDING MACHINES

A WE NEWS FEATURE



A WELDING ENGINEER photo

AT luncheon announcing completion of new electrode specification were (left to right) R. T. Brown, Metal & Thermit Corp.; Capt. R. E. Ball, Bureau of Ships; T. J. Griffin; E. F. Seaman, Bureau of Ships; and J. E. Norcross, Arcos Corp.

New electrode specification result of NEMA, Navy study

COMPLETION OF A SINGLE specification dealing with those items common to all specifications for covered welding electrodes was announced recently in Washington, D. C.

Issued by the U. S. Navy's Bureau of Ships, this new specification includes general requirements, quality assurance provisions, test procedures, as well as instructions for electrode delivery preparations.

More than three years of study by a special committee of the Arc Welding Section of the National Electrical Manufacturers Association, and a series of conferences with the welding branch of the Bureau of Ships went into the preparation of this specification.

In 1956 NEMA's Committee on Federal and Military Specifications found that many items in the various specifications for covered welding electrodes were common to all of them, and that each was stating the same thing in different terms.

Thus, users of these specifications were losing many hours determining whether the specifications were actually different or if they were similar or the same.

One immediate advantage of the new specification is that engineering staffs in government agencies will be able to use this general standard in preparing subsequent specifications.

Now all they need to cover any grade of electrode will be to issue a one or two-page document detailing the electrode's unique properties rather than the 20 to 30 pages of previous specifications, the bulk of which is common to all electrodes.

NEMA revises resistance welder control standard

A NEWLY REVISED standard for resistance welder control equipment has been recently published by the National Electrical Manufacturers Association.

Developed by NEMA's Industrial Control Section, the standard, "Resistance welding control IC-2-1960," includes definitions and cycle diagrams for all generally used resistance welding processes.

Definitions and diagrams are cross-referenced with a master table listing NEMA identification numbers for control equipment required to perform each of the described functions. All major control manufacturers list this equipment by NEMA number, as well as by their own model or type numbers.

Also listed are minimum standards for such factors as accuracy, time range, size and capacity, all of which are widely used in industry.

Separate sections are included for frequency converter controls, gun welder controls and multi-function process timers.

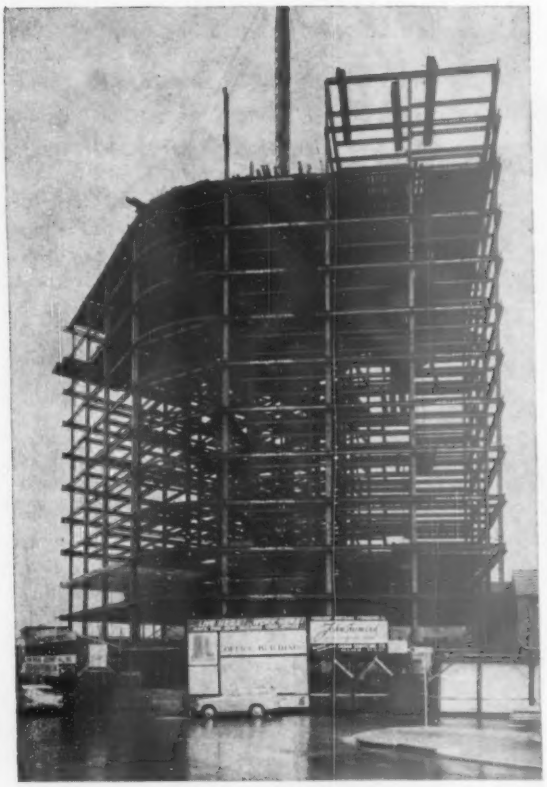
With this revised standard, all users of resistance welding processes will be able to select the proper control equipment for any welding job.

Copies of the 94-page standard are available from the association's office, 155 East 44th St., New York 17, N. Y., at $1.00 per copy.

Members of the NEMA committee are: Chairman J. E. Norcross, executive vice president, Arcos Corp.; C. M. Dick, product manager, electrodes and wires, welding division, Metal & Thermit Corp.; E. F. Helm, vice president, The McKay Co.; E. R. Lutes, vice president, engineering, Arc Rods Co., and R. A. Wilson, vice president, application engineering, Lincoln Electric Co.

Welded studs help to double floor load capacity

Steel and concrete design employed in strengthening two floors of new 13-story office structure.



STEEL superstructure of 13-story building going up. Floor loading capacity of second and third floors was increased 100%.

by Irwin G. Cantor*

WELDED STUDS were instrumental in a recent application of composite design principles to double the load capacity of the second and third floors of a 13-story office building at Forest Hills, Queens, N. Y.

After the first nine stories of the Mid City Center, being built by the Lefrak Organization, had been completed, a prospective tenant found that he had to have sufficient floor strength to accommodate live loads of 100 lb per sq ft instead of 50 lb, as provided in the original design.

The working design was standard short span construction with wire mesh and steel beams fully encased in concrete. Top flanges of beams were set 2-in. below finished slab, allowing a design stress of 22,000 psi in accordance with the New York City building code.

OPERATOR uses stud welding gun to install ¾-in. by 2-in. threaded studs on steel beams. Two rows of studs were placed on varying centers. Lower height of studs permitted lesser amount of additional concrete covering to be used.

At first, the designing engineers considered merely adding top and bottom cover plates, a conventional approach. This, however, was not feasible, since the formwork had already been placed and the wire hangers interfered with top cover plate placement. Ultimately it was decided to go to composite construction using stud shear connectors.

The local board of standards required a minimum cover of 1-in. above the top of the studs. Therefore, in order to keep added concrete to a minimum, since slab forms could not be raised, the Nel-

Mr. Cantor is a partner with the project's design engineering firm of Abrahams, Hertzberg & Cantor, New York City.

son Stud Welding Division of Gregory Industries, Inc., Lorain, Ohio, was asked to supply ¾-in.-diameter shear connector studs 2-in. in height. In this way, the amount of additional concrete could be limited to the minimum level.

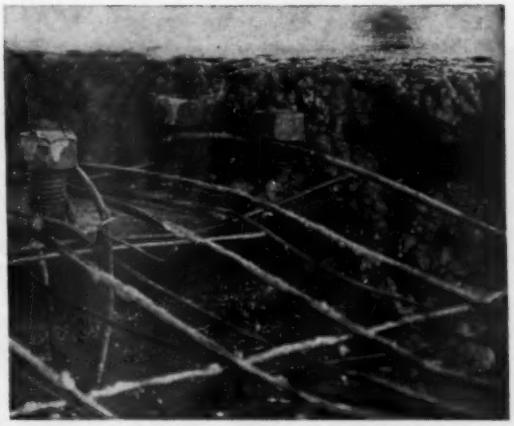
To permit immediate delivery, since the minimum length of standard headed shear connector studs is 4 in., Nelson engineers recommended the use of ¾-in. diameter by 2-in. threaded studs with nuts on top to serve the same function as the standard head. The studs, together with bottom cover plates, provided sufficient additional section modulus to carry the new loads.

A resourceful construction technique was used to block out concrete from the bottom flanges of the beams to allow room for the cover plates after form removal. It was too difficult to put stops between the steel beam and the side form, so sand was poured into the beam haunches to keep them clear.

Stripping proceeded smoothly and the bottom cover plates were then welded to the exposed flange. Vermiculite fireproofing completed the operation.

Experience with this job indicated that while an appreciable savings in materials and labor was effected, savings should be even greater in upgrading structures outside of New York City. Since the original design was based on an extreme fiber stress of 22,000 psi in steel, the engineers had to "give back" 2,000 psi in the re-design.

This resulted in reducing the overall effect of the composite beam. Had the design been at 20,000 psi, most of the beam sections chosen would not have required additional bottom cover plates.



CLOSEUP between pours for the second floor shows welded studs with nuts encased with concrete.

MODEL indicates completed appearance of Mid City Center. Building has approximately 10,000 sq ft per floor.

THIS view of the second floor was made before all of the reinforcing had been placed. Studs can be seen welded two and three abreast to girders and floor beams.

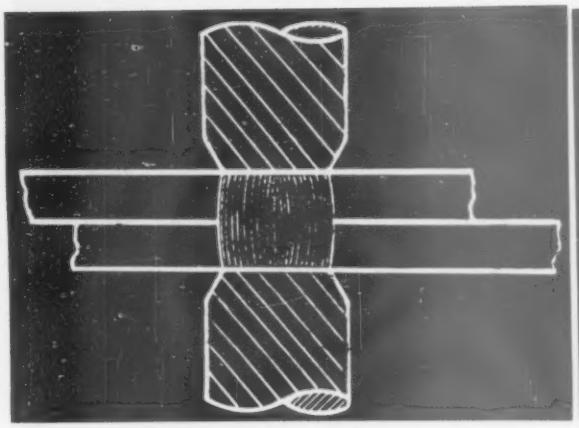


FIG. 1 — In ordinary spot welding, the area through which welding current passes is determined by the shape and size of the electrode points.

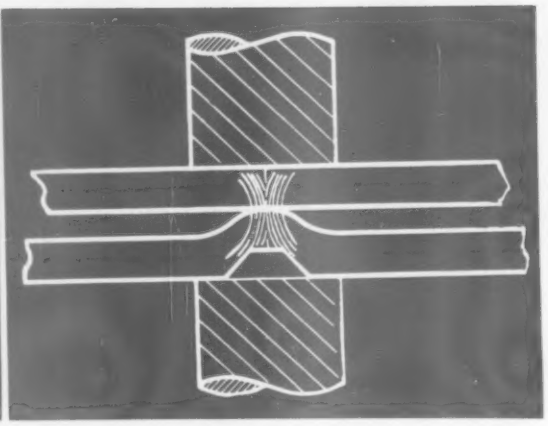


FIG. 2 — In projection welding, passage of welding current is confined to the point at which projection occurs, giving concentration and even distribution.

Fundamentals of projection welding

by **Douglas D. Williams**
Electro Mechan-Heat Ltd.
Surrey, England

IN ORDINARY SPOT WELDING, the area through which secondary current passes is determined by shape and size of electrode points.

These points also force the two work pieces together under pressure so as to obtain perfect contact in the weld's vicinity (figure 1). The thermal energy required to obtain localized fusion is derived from the electrical resistance of the junction between work pieces added to that of their combined mass.

In projection welding (figure 2) the area subjected to pressure and the passage of secondary current is governed by shape and size of the projections.

Because of the concentration and even distribution of current through these restricted surfaces, the amount of thermal energy freed at point of contact can be determined.

High initial current density produces high intensity heat, which, combined with the applied pressure, causes the contact area to grow progressively larger until the projections collapse and close contact between work pieces is made.

Such welds have the appearance of ordinary spot welds. However, to ensure their good quality, the projections and the immediate surrounding metal must fuse simultaneously. If they do not, molecular interpenetration will not occur between the surfaces.

Thermal equilibrium (*i.e.*, regular and simultaneous heating of both work pieces at point of contact) is important. If projections occur on one work piece only, these will heat more quickly than the smooth-surfaced piece.

Proper precautions must be taken so that these projections do not burn off or collapse before the surface of the other work piece reaches welding temperature.

Thermal balance is governed by several factors: thickness or masses of the components to be assembled; their differing electrical resistance; their shapes and the shapes of the projections; welding times used; and the shape and composition of the electrodes.

If the pieces are of different thickness, the thicker one will take longer to reach welding temperature. To obtain thermal balance, the projections should be formed on the thicker piece so that their masses conform to those of the thinner pieces at the points of contact.

In most cases, short welding times are desirable to make the best use of high contact resistance.

Projections may vary in shape as well as size, but generally, they must meet the following requirements:

1 — Position and form of the projections must provide sufficient mechanical strength to withstand electrode pressure, both before and during application of the welding current.

2 — Projections must have sufficient mass to avoid fusion and collapse before the opposing work piece has reached welding temperature.

3 — They must be of regular shapes which are relatively easy to produce.

Round and annular projections in sheet metal can be obtained easily by means of press tools. Their dimensions and those of the tools will vary with the gage of the sheet.

. . . and an unusual application

MAGNETIC-FORCE PROJECTION welding is currently being used by a novelties manufacturer to join painted-steel strip — without marking the paint.

The welder, made by Precision Welder & Flexopress Corp., Cincinnati, can join brackets, hinges, braces and other parts to the back (uncoated) side of pre-formed decorative steels, widely used for appliances, luggage and automotive parts (see photo).

(Vinyl-coated steel was the first of such materials to attain prominence).

In magnetic-force welding, the same current surge which brings the parts to welding heat is used to energize a magnet. The magnet drives a forging hammer down on the weld projection, upsetting it at the instant of maximum heat.

This method is practical on stock as thin as 0.015 in., including the coating. Size of the weld nugget is limited by the thickness of the material, but weld strength equals AWS standards for 20 gage vinyl-coated steel.

Projections on massive work pieces can be obtained by machining, stamping or forging, and can be round, elongated or annular. Development of special weld bolts and nuts (with suitable projections stamped on their head or rims) has facilitated attachment of threaded components to metal surfaces.

Vee-section annular projections (figure 3) produce intense local heating because of their heights and shape. This is because of the restricted area initially available to the current with correspondingly high contact resistance.

Tight welds with mechanical properties equal to those of the surrounding metal can be readily obtained.

A variation of the annular projection (figure 4) has channels on either side of the annulus. These accommodate any surplus metal, achieving perfect contact between the two sheet surfaces after welding.

Perfect contact cannot be obtained without this arrangement. However, strength properties of welds made with or without channels are almost identical.

Using projection welding, several welds of equally high quality can be made simultaneously, resulting in greater rigidity of the final assembly.

Round projections are frequently used for joining sheets and pressed components, since they ensure an even distribution of energy between welds due to identical pressure and contact conditions at all points.

Projection welding is also used, for example, in attaching fins to rocket projectile bases, where the initial rigidity of the components makes it difficult to obtain close contact between surfaces.

In multiple spot welding, one problem is rapid wear of electrode points because of their smaller surfaces. It is also more difficult to obtain even distribution of pressure between various spots.

In projection welding, however, the number of welds which can be simultaneously applied is governed only by the power output of the welder. The welds can also be placed closer together without any danger of imperfections due to current shunting.

And finally, projection welding can be used frequently for the assembly of components which, because of shape, mass or special welding conditions, cannot be either spot welded or butt welded.

Some work pieces have natural projections due to

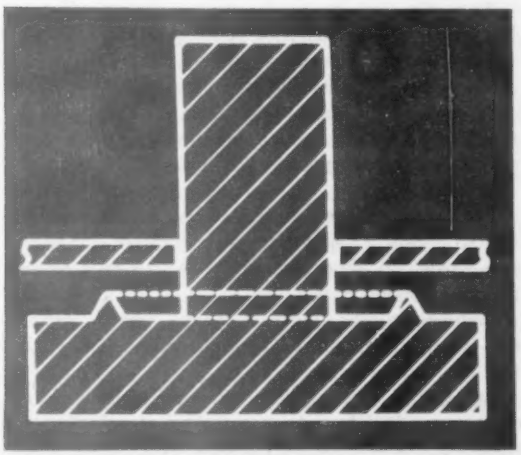


FIG 3 — Vee-section annular projection on the inner face of a weld.

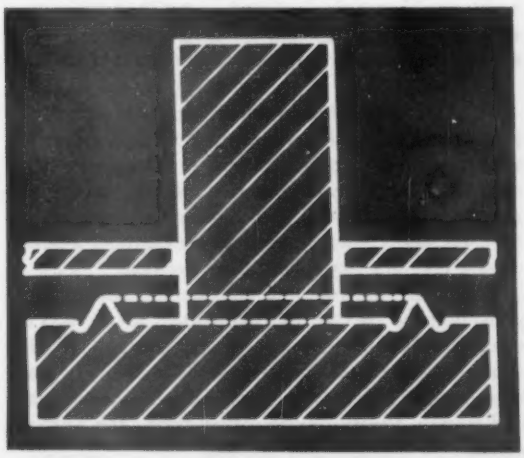


FIG. 4 — Vee-section annular projection with additional channels for surplus metal.

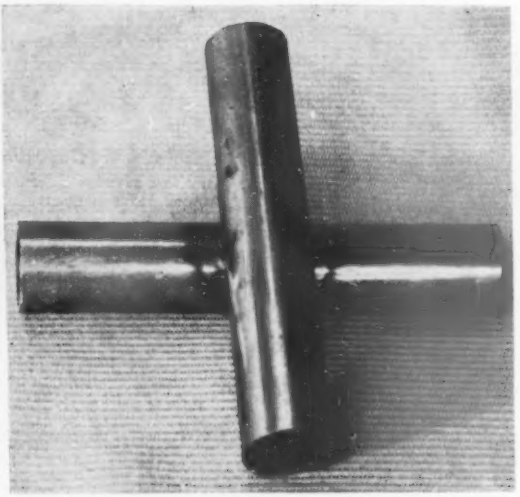


FIG 5 — A cross weld between two 1-in.-diameter tubes with wall thickness of 1/16 in.

FIG. 6 — Chromium-plated tubes cross-welded together without visible surface damage.

their geometrical shapes, so if placed together in certain attitudes, good contact over a restricted area will be obtained.

Chief among these are all tubes. When laid crosswise one on the other, their surfaces meet in a point and can be projection welded without further preparation.

During welding the area of contact increases due to the progressive collapse of both work pieces as the temperature rises. Amount of collapse can be controlled by the welding time and current density used.

The smaller the included angle between two tubes, the greater their area of contact, which reaches a maximum when the tubes are in line. Current density and welding time required will depend on the dimensions of the tubes as well as on their contact area. Electrode pressure will be limited by their mechanical strengths.

Figure 5 shows a cross-weld between two 1-in. diameter tubes with wall thickness of 1/16 in. A weld time of about 30 cycles was used, resulting in a large weld area but only localized heat. Thus there was little surface damage and no deformation. Figure 6 shows chromium-plated tubes welded in the same way.

For many projection welding applications the simplest cycle of operations is adequate: (a) bringing the workpieces together under pressure; (b) welding time; and (c) holding or forging time, during which the pressure is maintained after the welding current has been cut off. Current density and electrode pressure remain constant throughout the operation.

Frequently, however, the shapes and masses of components to be welded, the steels used, or the special mechanical and metallurgical properties required, demand more elaborate techniques. Thus, welders have been fitted with control equipment whereby pressure and current density can be varied during the welding cycle.

For example, the projection welding of heavy mild steel sections, requiring considerable electrical energy, would give rise to two serious imperfections if a simple welding cycle with constant pressure and current density were used.

At the beginning of the operation, some molten metal would be expelled with partial destruction of the projections. After welding, the molten zone would contain porosity.

The first effect is caused by high initial current density combined with the natural inertia of the welding head. The head fails to follow up the collapsing projection with sufficient speed to prevent some molten metal from escaping.

Thus, pressure must be raised during the early cycle stages while the initial current density is reduced to prevent too-rapid heating of the projection tips.

Porosity occurs during the later stages of the operation and is caused by formation of gas bubbles in the molten metal and its extrusion between the two work piece surfaces due to thermal expansion. Thus, pressure must be raised again in the latter stage.

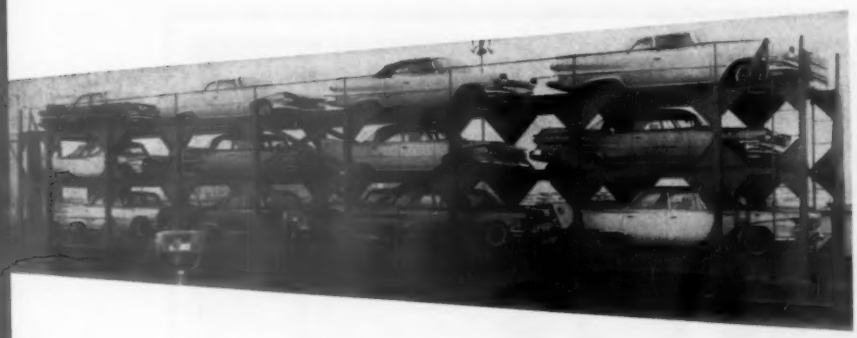
Projection welding can be used on carbon and stainless steels, on the majority of alloyed steels, on galvanized or tinned steels and, under certain conditions, on aluminum and its alloys.

It can also be used for joining dissimilar metals, (steel to brass, steel to aluminum, etc.), but some applications require special techniques. (*See box.*)

For example, steels with a carbon content exceeding 0.3% show a tendency to embrittlement due to the case hardening effect around the molten zone caused by rapid cooling of the weld.

Reducing the heating and cooling rates minimizes this effect and requires a further modification of the welding control cycle.

In practice this is done by having the welding current supplied in three separate electronically-controlled pulses of differing intensity with a short interval between each. In this way, the work is preheated before welding and subsequently annealed.



WELDING produced the tri-level railroad car (left) and the aluminum trailer truck (below) and had a definite role in fabricating the 1960 automobiles they carried, as well as the 1961s on the way.

By rail . . . .

. . . . or trail

Welded cars travel on welded carriers

ONE MAJOR SELLING POINT of several 1960 automobiles was their welded construction as are many of the newly-introduced 1961 models.

Whether it's called Uni-body, Single-unit or Monopiece (the last term was reported some 30 years ago in WELDING ENGINEER, December, 1929, p. 49), welding is recognized by the automotive industry as offering new strength, economy and safety.

One such manufacturer has gone so far as to fill the trunk of one of its cars with sandbags and driving it on three wheels from Chicago to Detroit to prove its strength and ruggedness of construction.

However, as in any other welded product, welding appears on the scene long before the product itself is produced — in this case, the means of transporting these automobiles.

A new three-decker railway car was recently introduced by the Frisco Railroad to expand its facilities for factory-to-dealer shipments of automobiles.

The 85 ft, 8 in. long car, capable of carrying 12 full-size or 15-compact autos, was built by Pullman-Standard, Chicago, in a record 21 days.

This tri-level carrier is the joint effort of the Chrysler Corp., the Frisco railroad and Pullman-Standard engineers to develop a car that could carry the maximum number of autos over the rails. It is reportedly the largest ever built for the sole purpose of piggybacking automobiles.

Weighing 105,000 lb and standing 14 ft, 2 in. high, the car was manual-arc and submerged-arc welded in the shop from high-tensile, low-alloy steel stock ranging from 1/4 to 1-in. thick.

Manual arc welding was done with E6012, E6020 and E7016 electrodes in diameters of 3/16, 1/4 and 5/16 in. Current used was a-c, ranging from 260 amp, 25 volts to 450 amp, 36 volts.

For submerged-arc welding, wire sizes were 3/32, 5/32 and 3/16 in. in diameter. Here the current was d-c from 450 amp, 29 volts to 1,050 amp, 32 volts. Submerged-arc units were both full- and semi-automatic.

As W. G. Boese, Pullman-Standard's chief welding engineer stated: "It would have been rather difficult to build this car by any other means than welding. Here, again, by welding there is a saving in weight and a stronger product."

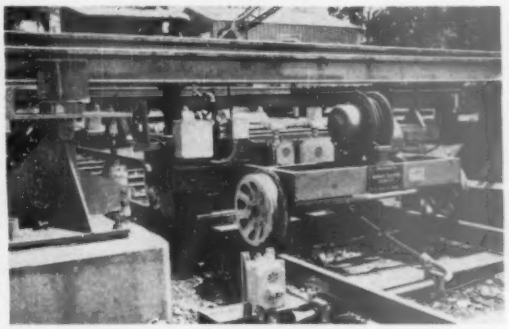
Piggybacking brings to mind trailer-trucks and one such auto carrier manufacturer, not to be outdone, is also taking advantage of the "carry-more-for-less" plan offered by welding.

Westland Trailer Co., Portland, Ore., is manufacturing welded aluminum auto-transport trailers that cut fuel and tire costs 10% and increase payload by one car. A smaller trailer model converts into a flat-bed carrier for boats or freight on the return haul.

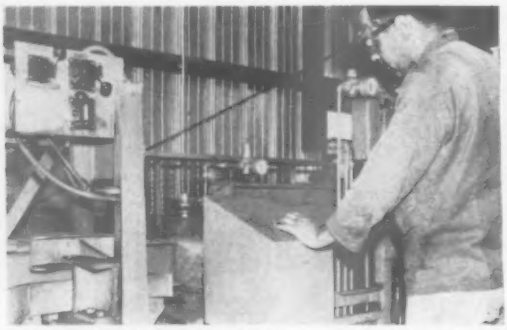
Company spokesmen agree that semiautomatic Mig welding is the fastest way to fabricate low-cost component parts. Hence, the units are completely fabricated of welded aluminum, except for the steel axles.

Skids, rails and ramps on truck and trailer are made of 6062 aluminum alloy while the raised deck tubing is 6061. All aluminum castings, designed by the firm, are 356T-6 aluminum alloy.

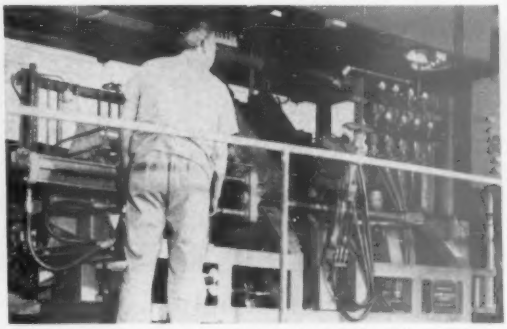
Aluminum wire used for Mig welding was manufactured by All-State Welding Alloys Co., Inc., White Plains, N. Y.



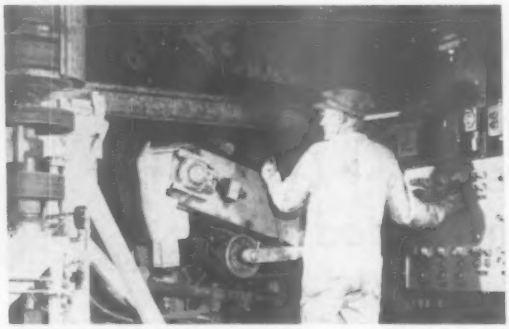
I—Fully automatic handling car picks up rail sections from storage rack, deposits them in production line.



II—ENDS of rail are squared prior to welding. End finishing machine utilizes abrasive belt grinder.



III—FOUR water-cooled torch tips heat rail ends to plastic state in this new welding machine.



IV—UPSET metal formed by pressure weld is ground from all four sides of rail.

Oxyacetylene pressure welding of rail arrives at the push-button stage

AUTOMATION HAS COME to the oxyacetylene pressure process for welding rail.

Linde Co., New York City, in late September unveiled its new system before about 100 top engineering officials from key American railroads. The firm's Oxweld Railroad Dept. ran a special train from Chicago to Fond du Lac, Wis., where its Ribbonrail equipment was welding rail for use on the Soo Line's rights of way.

What these engineering officials saw was push-button welding and handling of rail.

From the moment new rail — in the standard 39-ft sections — is unloaded onto storage racks, it is automatically controlled throughout the production process.

Rail is selected from the racks by automatic rail handling cars which lift the rail and carry it to the production line at a speed of 40 ft per minute. Completely automatic, these electro-mechanical units (themselves mounted on rail) hold each rail section until it is needed. Then they deposit it in place on the production line, shuttle back to the storage rack, and select the next section.

Because they are equipped with a series of sensing devices, these machines can tell when and where new rail is needed. The same devices also render the units fail safe. Should a workman accidentally get in the way, the car immediately will stop.

The question . . .

Most frequently asked about welded rail concerns expansion and contraction caused by temperature changes.

The answer . . .

A long stretch of continuous welded rail is restrained from expanding and contracting longitudinally by rail anchors, spikes holding the rails in place, frictional resistance on the tie plate, as well as the gripping action of the plate shoulders. This combined resistance minimizes expansion and contraction to a small movement at each end.

After rail is placed on the production line, a power roll automatically advances it to a device called an idler lift roll. This lift roll is actuated by the operator of the end finisher, which is the first manned machine on the production line. (Actually, there are two idler lift rolls — one on either side of the end finisher — and once they are turned on, they automatically compensate camber of the individual rail by a series of air pressure devices.)

As this occurs on both sides of the end finisher, guide plates align rail ends in the finishing machine. Critical tolerances are maintained here as the gage side of the rail is aligned to a tolerance of 0.015 in. while the top of the rail ball is aligned to within 0.025 in. A moving abrasive belt grinder squares the rail end and removes excess metal from the area.

When the leading end is squared, the rail section is advanced and the same procedure takes place on its trailing end.

Welding rail ends together is the next step in the production process. Another power roll forwards the rail to the welding machine. Butted to the trailing end of the previously welded section, the rail is aligned by a series of dies, and an end pressure of about 3,000 psi is applied.

Four water-cooled torch tips form a welding head that surrounds the rail ends. The oxyacetylene flames heat the metal to a plastic state, and the ends are fused under pressure, which is continuously exerted throughout the four minutes it takes to complete the weld cycle.

The rail is then automatically advanced to the grinding machine by means of a power pinch roller. In one grinding operation, excess upset metal around the joint is removed from the ball, base and web of the rail. The rail is inspected with a magnetic-particle process and loaded abroad a rail train for shipment to the laying point.

At the Soo installation in Fond du Lac, the welds joints were also normalized. However, Linde officials said normalizing is not necessary, but if a customer railroad wishes such equipment (or such service), they will provide it.

by F. T. Tancula

LENGTHS of continuous welded rail are unloaded along right of way.

More than million welds dot nation's railways

Based on the latest information available to *Welding Engineer*, railroads in the United States own about 5,400 miles of welded track, or 10,800 miles of rail.

Within this network of welded rail are contained 1,350,000 welds. This figure is based on an estimated 250 welds per track mile. Naturally, there will be variations, as some roads have welded rails sections of 1,482 ft (38 standard 39-ft sections), the most popular length; others have shorter or longer continuous rail, depending upon rights of way, terrain, curves, etc.

At the Soo Line installation described in the adjoining story, 22 sections were joined to form 858-ft lengths of 115-lb (per running yard) rail.

What are the economies of welded rail?

The American Railway Engineering Association, as a result of a 1957 survey, estimated the average railroad saved $981 per track mile by installing continuous welded rail. That figure is probably well over $1,000 today.

How do railroads get their rails welded?

Today they have a choice among three basic methods:

1. They can lease equipment and operate it with their own personnel (the vendor usually supplies a service engineer);
2. They can have rail welded by contract at a fixed plant (Where equipment, site, etc., are owned by the vendor); or
3. They can purchase welding equipment outright.

Some railroads have shared expenses with other roads in buying or leasing equipment.

Since there are only four steel mills in this country still rolling rail, major producers of welded rail have located their fixed-plant sites near these mills.

The mills are at:

Steelton (Harrisburg), Pa., Bethlehem Steel Co.;

Pueblo, Colo., Colorado Fuel & Iron Corp.;

Gary (Ind.) Works, United States Steel Corp.; and

Ensley (Birmingham), Ala., Tennessee Coal & Iron Div., U. S. Steel.

Linde Co., New York City, has contract plants near the Steelton and Ensley mills. National Cylinder Gas Div., Chemetron Corp., Chicago, has its Schlatter system of resistance welding rail at Pueblo and also at Ensley. Matisa Railweld, Inc., Chicago Heights, Ill., has its resistance welding equipment set up at Summit, Ill., not too far from the Gary mill. It, too, has a fixed plant near the Ensley mill — at Bessemer, Ala.

At these contract welding sites, dual welding lines are the rule—an arrangement that makes for obvious economies.

Continuous welded rail is gaining wider acceptance but it still faces some obstacles. The chief one: welded rail requires high-quality ties and roadbed, which for many roads would mean tremendous expenditures to upgrade their rights of way.

FIG. 1 — Tig torch is held vertically in welding positioner for rotation.

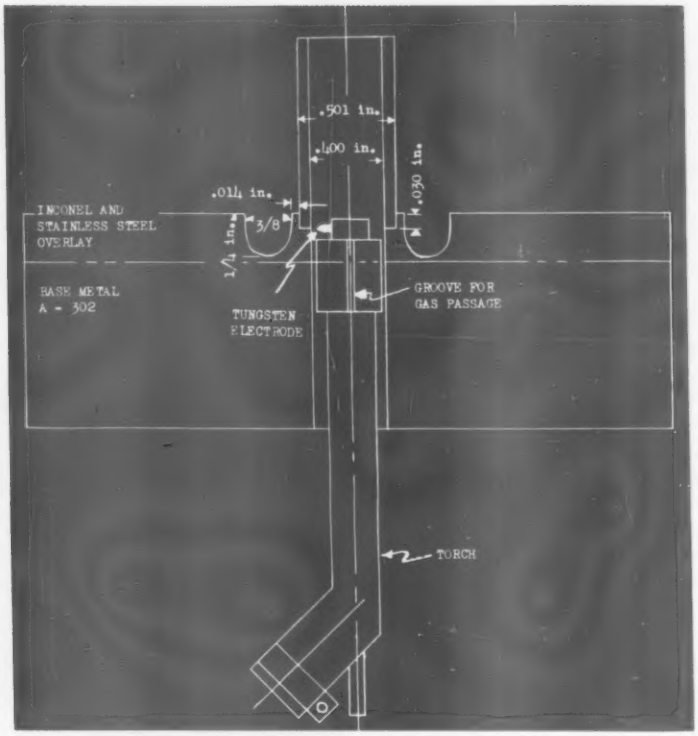


FIG. 2 — Cutaway view of tube-sheet extension showing weld preparation and Tig torch in position.

Tig welding joins small stainless tubes to thick tube-sheet

by **Dr. J. M. Gerken**
and **D. B. Kittle**
Knolls Atomic Power Laboratory Schenectady, N. Y.*

STAINLESS STEEL TUBING as small as 0.240-in. ID by 0.035-in. wall thickness can be internally butt welded successfully to thick tube-sheets using Tig welding.

This technique (proved in design of nuclear power plant heat exchangers) is an application of a process developed a few years ago by Griscom-Russell Co. to produce a tube to tube-sheet weld free from crevices. The tubes involved are believed to be the smallest ever welded from the inside.

Two different sizes of tubing were internally butt welded: 0.402-in. ID by 0.049-in. wall thickness; and 0.240-in. ID by 0.035-in. wall thickness.

Welding on the former was done by using a torch (figure 1) whose electrode-bearing head was painted with a special compound for insulation purposes. The torch was held vertically in a welding positioner for rotation, while the work was in a fixed position.

The outer diameter of the ceramic sleeve was machined 0.010 in. under the hold diameter of the stainless steel tubes being welded to allow clearance for rotation and passage for the argon shield.

Four small grooves were ground longitudinally along the outside of the sleeve to further increase passage for the argon, which entered one end of the tube, passed by the arc, and out the tube sheet bottom.

This sleeve centered the torch in the tube and insulated it against the arc's high-frequency current and heat radiation. Current was cut down to a low value with each weld's completion before the arc was extinguished, thus providing a tapering effect at the overlap to prevent arc crater formation.

Preliminary work was performed by butt welding 3-in. lengths to 6-in. lengths of type 347 stainless tubing by inserting the torch through the 6-in. tube.

At first these tubes were welded with a close-fitting copper chill block placed over the outside of the tubes. However, because of excessive chilling effects, even with relief grooves under the joint inter-

* Operated by the General Electric Co. for the U. S. Atomic Energy Commission.

face, their use was abandoned and argon substituted.

The argon was contained in a plexiglass box built around the tubes being welded. Five of these tube butt welds, made under conditions listed in table 1, were dye-checked, mass-spectrometer leak-tested, and X-rayed; two were also tensile tested.

The simulated tube-sheet was prepared by overlaying a block of A-302 steel, with one layer of Inconel filler metal and three subsequent layers of 347 stainless, thus making a total overlay thickness of 7/16 in.

Tubular extensions were then machined in this overlay as shown by the cutaway view in figure 2. Two of these extensions ready for welding can be seen in figure 3. Also visible is the torch being inserted through the bottom of the tube-sheet. Tubes previously welded (under conditions listed in table 2) can be seen directly behind.

These welds were dye-checked, mass-spectrometer leak-tested and X-rayed. Some were also sectioned and examined metallographically.

Three additional simulated tube-sheets were prepared from 347 stainless steel, each with six weld preparations. The tubular extensions were machined as mentioned above with two exceptions: (1) the height and thickness of the lip, which holds and centers the tube, were reduced from 0.030 and 0.015 in. to 0.014 and 0.008 in. respectively, and (2) the tube extensions 1, 2 and 3 in tube-sheet number 2 were machined to a 10-deg bevel.

Type 347 stainless tubing ½-in. OD by 0.049-in. wall thickness was then welded to these simulated tube-sheets with a special torch.

The torch for welding the 0.250-in. ID tubes to tube-sheets consisted of a 0.040-in. thoriated-tungsten electrode angled 90 deg so that its tip was perpendicular to the tube wall.

The electrode's opposite end was inserted through a 0.230-in. OD ceramic sleeve, approximately 1-in. long and secured in the end of a 0.250-in. OD copper rod. This end was held fast in a chuck which rotated the torch while the work remained stationary.

Three simulated tube-sheets were machined from 0.250-in.-thick 347 stainless with six extensions each of the same contour as shown in figure 2. The differences in the tube extensions were: 0.180 in. high; 0.329 to 0.337-in. OD; 0.240-in. ID and the recess in the top of the tube extension was 0.309 to 0.312-in. ID, leaving a lip 0.010 to 0.014-in. thick with a height of 0.028 to 0.030 in.

Stainless steel tubes 3-in. long were welded to the tube extensions of one tube-sheet while the other tube-sheets were welded to opposite ends of five 10-in.-long tubes. All these welds were made with the same procedure as the welds in the 0.250-in. OD tubes.

The weld zone was protected by containing the work in a plexiglass chamber filled with argon. At the same time, argon was forced through the tube being welded.

FIG. 3 — Two machined extensions are ready for welding; also visible is torch being inserted through bottom. Previously welded tubes are directly behind.

Final results of all the tube-welding tests showed:

The five butt welds joining the 6 and 3-in. lengths of stainless tubing had a good appearance and all welds passed the dye-check and mass-spectrometer leak tests. Radiographic examination showed the welds free of defects, while tensile tests showed that two tubes (9 and 10 in table 1) had good strength and ductility.

Number 9 had a tensile strength of 88,600 psi and number 10 had a tensile strength of 85,700 psi, with fracture occurring in the softer weld metal. These values were considered good since they were

Butt welding between tubes

Specimen No.	Argon gas flow, cfh: Through tube	Argon gas flow, cfh: Shielding around tube	Amp d-c, sp	Arc in.	Rotation time, sec.	Welding speed ipm
7	6	5	29	0.029	10	7.5
8	6	5	31	0.020	10	7.5
9	6	5	31	0.020	10	7.5
10	6	5	31	0.020	10	7.5
11	6	5	30	0.020	10	7.5

TABLE 1 — Conditions for making butt welds between type 347 stainless steel tubes, 0.402-in. ID by 0.049-in. wall.

well within the range of 80,000 to 90,000 psi for annealed base metal.

In the simulated tube-sheet, all welds except one passed the mass-spectrometer leak test, and the one failure appeared to have a leak in the machined tube-sheet extension rather than in the butt weld.

Dye-check tests gave indications of incomplete penetration in four welds. Radiographs were taken of the outside tubes, but because of the inaccessibility of the welds to more than one view, and because visual examination proved some X-ray indications to be wrong, the value of X-raying was questionable in this case.

The welds made in the stainless tube-sheets were satisfactory in all the joints except the ones which had the 10-deg bevel on the tubular extensions. Two of these did not have complete penetration even though they were welded with two passes.

The conclusions were that butt welds joining the tubes had good quality and most of the welds of the tubes to tube-sheets were good. Weld heat input, which was adequate for welding tubes to tubes, was not great enough to make full penetration welds in tube to tube-sheet.

As figure 2 shows, the reason for lack of full peneration was that the wall of the tube-sheet extension was 0.015-in. thicker than the tube wall and had a lip to facilitate joint fit-up and provide filler metal. Slightly higher heat input was thus required.

The succeeding welds made in the stainless sheets were all good except those made with a 10-deg bevel. Changing the position of the tungsten electrode in relation to the joint would give better control of weld drop-through. The electrode was thus positioned so that the arc strikes more directly on the heavier tube-sheet extension side of the joint than it does on the tube.

Welding tubes to tube-sheet

Weld No.	Through tube	For shielding	Amp d-c, sp	Arc Length in.	Time per revolution, sec.	No. of revolutions
1	6	5	30	0.020	15	1
2	6	10	30	0.020	15	1
3	6	10	30	0.020	10	1
4	6	10	31	0.020	12	1
5	6	5	30	0.020	12	1
6	6	5	31	0.020	10	1
7	6	5	32	0.020	10	1
8	6	10	32	0.020	10	1
9	6	5	31	0.020	10	2
10	6	5	32	0.020	10	1
11	6	5	31	0.020	10	2
12	—	20	35	0.020	10	1
13	2	10	34	0.020	10	1
14	4	10	34	0.020	10	2

Weld	Description of Weld Quality
1	*Slight porosity and excessive weld drop through due to excessive heat caused by slow rotation.*
2	*Same as No. 1.*
3	*Insufficient penetration because the rotation speed was too fast.*
4	*Insufficient penetration in one area which may have been caused by electrode being slightly off the joint.*
5	*Good outside appearance and good penetration.*
6	*Good outside appearance and good penetration.*
7	*Same as No. 5 — A leak was detected in this tube by the M.S. leak-test. However dye check indication showed a defect in the tube-sheet extension below the weld but none in the weld.*
8	*Good outside appearance and good penetration except in one small area approximately ⅛-in. long.*
9	*Good outside appearance but X-ray showed slight porosity.*
10	*Good outside appearance and good penetration except in one small area approximately ⅛-in. long.*
11	*Good outside appearance and good penetration except in one area approximately ½-in. long.*
12	*Undercut and porosity.*
13	*Good outside appearance and good penetration.*
14	*Good outside appearance and good penetration but X-ray showed slight porosity.*

TABLE 2 — Conditions for welding tubes to simulated tube-sheet.

Jet fuel line is Mig welded

MIG method is used by welder to join sections of aluminum pipe for jet fuel line.

CREW aligns pipe sections on wooden cross-beams where sections will be welded before being lowered into trench.

AN UNDERGROUND FUELING system for jet aircraft made by Mig welding 35-ft lengths of seamless aluminum pipe has recently been completed at Lemoore, Calif.

More than a mile of 16-in.-diameter pipe with a ½-in. wall thickness, supplied by Aluminum Co. of America, has been installed to service Navy jets at Lemoore Naval Air Station.

Because it does not react with aviation gasoline and kerosene to form gum and sludge, aluminum is well qualified to handle jet fuel.

During installation, pipe sections were handled by a simple "A" frame crane mounted on a two-ton truck. Each new length was lowered, adjacent to the completed portion of the line, onto wooden crossbeams spanning the trench width.

A three-man crew aligned the pipes on the beams where they were Mig welded. When the final section was welded, the line was lowered into the trench and covered.

The king-size pipe now receives fuel that has passed through a large filter-separator unit. The separation process, using aluminum-lined tanks and aluminum pipe, removes contamination formed in the fuel during storage and transfer.

Approximately 6,000 ft of this alloy 6063-T6 pipe was used in this installation.

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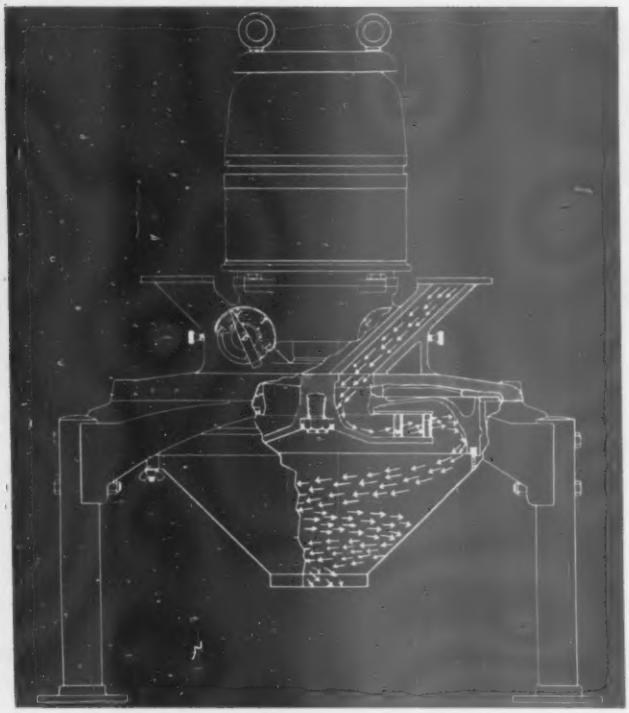


BASIC principle of centrifugal impact mill — arrows show flow of product from inlet chute, through rotor and into hopper.

Carbon, stainless steel welded in fabrication of centrifugal mills

WELDED DESIGN FLEXIBILITY — the ability to "spot" extra strength and vibration resistance where it is needed — is particularly important in building special machinery for the process industries.

Frequently, minimum cost and weight are of equal significance. A further consideration is the possibility of a composite construction with dissimilar metals — carbons and stainless steel, for example.

These were a few of the factors bearing on the design of current models of "Entoleter" centrifugal machines used for centrifugal impacting, mixing, aspirating, blending and hulling.

The word, coined from the Greek "entomon," meaning insect, and "oleter," meaning destroyer, dates back to about 1940 when the first centrifugal machine was devised for the control of infestation in wheat and other grains and food products. It is now built in several sizes by a division of Safety Car Heating and Lighting Co., Inc., New Haven, Conn.

Among typical products being handled in current installations are paint pigments, polyvinyl and record scrap, plastic powders, granular food products, chemicals and the coating materials for welding electrodes.

According to the requirements of the installation, the machines may be equipped with stainless steel inlet chutes, rotors, liners and hoppers. Abrasive products may dictate use of wear-resistant alloys in impactors and liners; thus each unit is more or less tailor-made for the installation.

Where stainless steel is required to avoid corrosion, the parts in contact with the product are fabricated from type 316 chrome-nickel stainless and welded with electrodes of the same material to a carbon steel top plate.

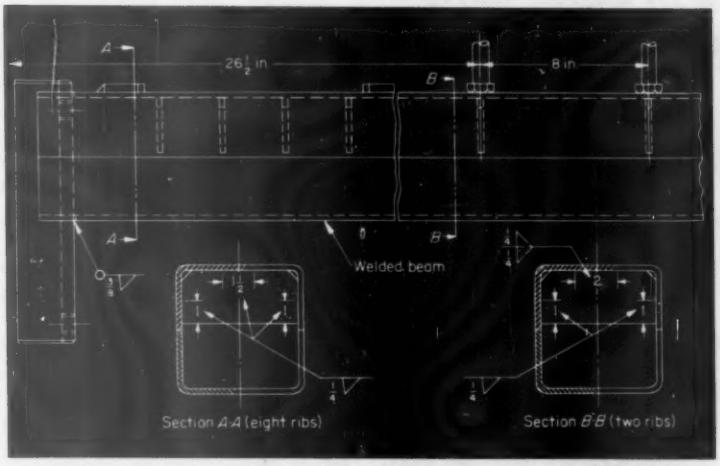
In some earlier designs of Entoleter bodies, consideration was given to the use of castings. In one, a typical stainless steel casting would have cost in the neighborhood of $1,150, with patterns, and would have weighed 669 lb.

Switching to welded carbon and stainless steel combination, cost was cut to about $600 and weight to 350 lb. Principal weight saving came from a reduction of wall thickness from ½-in. for the casting to ¾-in. for the weldment.

Another welding application is in the horizontal box-section beam of the main frame. This machine has a 40-in. diameter rotor and the high peripheral speeds involved posed a serious vibration problem. By fabricating the beam in two halves of formed plate, it was possible to

PREVIOUSLY used casting was replaced by welded assembly. Casting design did not permit composite construction as used in weldment.

ASSEMBLY of top plate, inlet chutes and body cover. Stainless steel chutes are welded to carbon steel top plate for lower cost.



CROSS section of assembly shown above. Note how stainless weld bead is carried up over top of chute to avoid contact of product with top plate.

weld internal stiffener plates at any desired points to bring the resonant frequency of the beam below the machine's operating range. This would not have been possible with the use of a conventional rolled box beam.

The unit's operation is as follows: the product under processing flows through a central inlet to chutes which feed onto a spinning rotor operating up to 5,000 rpm. The product is driven outward by centrifugal force against impactors at the rim of the rotor which direct it against the liner of the body and then down into the hopper. Force is sufficient to give a high-intensity mix or reduction in size of the product.

Being true centrifugal mixers and impact mills, the machines rely entirely on the action created by accelerating to a high velocity and shattering the material suddenly by collisions with a target area.

When particle size reduction is desired, the degree of reduction can be controlled primarily by impact velocity and the type and size of rotor and liner.

Another model, the largest built, is designed for impact velocities in excess of 30,000 fpm, with drive motors up to 150 hp, and capable of processing well over 100,000 lb. of material per hour. Welding equipment and electrodes for the centrifugal mills were furnished by Lincoln Electric Co., Cleveland, which also worked closely in supervising welding procedures.

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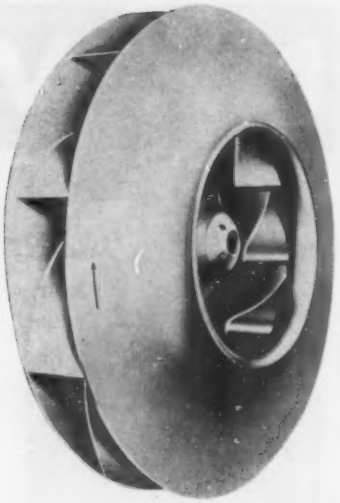

by William C. Nemitz
Sturtevant Div.
Westinghouse Electric Corp.
Hyde Park, Mass.

FIG. 1 — Redesigned fan wheel makes extensive use of welding, illustrates need for improved process controls.

Welded design, process control guarantee better products

ONLY BY ESTABLISHING improved controls can a welded product requiring high reliability joints achieve the laboratory-proved strength expected by its designer.

A welding development program, supported by such a system of controls, has contributed to many product improvements at the Sturtevant Div. in recent years.

The most impressive, with respect to welding process control, are the heavy fans used in power plants.

A few years ago a typical forced-draft fan used a wide, flat-bladed wheel in which the blades were riveted to side and back plates. Today, two developments have necessitated introduction of carefully controlled welding in building these wheels.

First, blade shape was changed from a flat or curved plate to a hollow airfoil, so riveting was no longer practical (figure 1). Second, trade requirements calling for higher output pressure changed the wide paddle-wheel to a narrow wheel rotating at a much greater speed, (*e.g.*, a maximum tip speed of 38,500 fpm compared to the previous maximum of 20,000 fpm).

Development of this wheel illustrates the close coordination required between engineering and manufacturing personnel, and the need for maintaining close controls after the design and welding process are determined.

One of the first design problems was to join the blades first to the back plate at the wheel's hub side, and then to the side plate at the inlet side.

With possible tip speeds of over 40,000 fpm, high bending and sheer stresses are set up at this joint. But by forming the blade edges (figure 2) weld metal can be placed on both sides of the joint's neutral axis, thus gaining maximum benefit from weld metal.

Besides forming the bevel on the blade edges, the blades and plates are machined for good fit-up with about a ⅛-in. land on the blade edges to prevent burn-through. Where plate surfaces are contoured, a corresponding contour is required on blade edges.

With joint design established, the welding process was the next consideration. Because of the complex shape and low-activity of any given size, manual metal-arc welding with a low-hydrogen powered-iron electrode was chosen.

Tensile tests, as well as face and root bend tests, were conducted to evaluate the electrode's tensile strength and ductility. Further samples were X-rayed to confirm the weld metal's soundness.

Weldment shape (as well as proper fillet shape and complete absence of undercut) required that the wheel be positioned carefully with several slight changes in position as welding progressed. To prevent cracking of the 8620 base metal, a preheat of 250 to 300 F was used.

Because of the wheel's mass, its difference in cross section and large open spaces, it was rotated on the positioner with several radiant gas burners under the wheel. Thus, it was brought to a uniform preheat and maintained during welding.

To minimize residual stresses, the weldment was stress relieved before finish machining. The wheel was brought to 1,150 F at a rate of 50 F per hour and cooled at a controlled rate.

The weldment's critical nature dictated careful inspection of its component parts prior to welding and frequent inspection of the weld joint as work progressed. Blades and plates were magnetic particle inspected to detect any nonmetallic inclusions or laminations, and a similar inspection was conducted after the root pass and after each alternate layer of weld metal.

All of these considerations were detailed in a process specification which served as a guide for routing the work, maintaining the proper conditions and performing necessary quality checks.

However, even with all this ground work, successful welding of the wheel depended greatly on qualified weldors. Thus, all applicants were given two qualification tests.

The first was the standard Navy

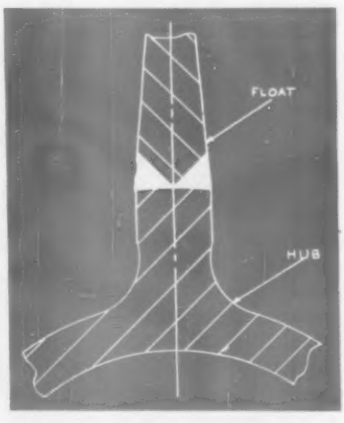

FIG. 2 — Beveling of blade edges makes maximum use of weld metal's benefits.

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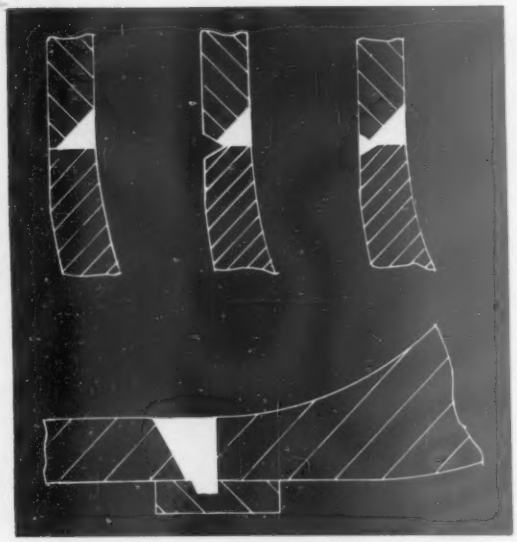

FIG. 3 — Original plan to weld, gouge and reweld was changed to a back-up strip joint design (below).

Qualification Test for vertical welding. The second test was similar, except that the backing strip and root opening were eliminated. The weld's reverse side had to be arc-aired to sound metal and rewelded for 100% penetration. All testing was done with the low-hydrogen electrode selected for the work.

When actual welding began, two problems had to be solved. Temporary tack welds used to set up the wheel cracked during preheat. The simple solution was to preheat parts prior to tack welding and maintain this heat during assembly.

The second problem was underbead cracks at the weld's toe while welding progressed. Their appearance and position suggested hydrogen pick-up from excess moisture in the electrode's coating.

Although the electrodes were removed from sealed cans and stored in ovens at 200 F, tests showed that moisture was rapidly absorbed after removal from the ovens, rising to 0.3% in the first hour.

Heating to 500 F slowed moisture pick-up to 0.1%, which was established as maximum and was not reached for two or three days after removal from the ovens.

The foregoing has dealt with one specific wheel design. However, most other welding is covered by similar controls, although to a lesser degree. Process controls, qualification tests and quality checks are set up for each job in view of its design requirements and final application.

For example, large complex forgings for side plates and back plates of certain wheels were redesigned into simpler forgings with welded plate to make up the full diameter.

Quality standards were easier to maintain. The improvement was further enhanced by changing from the original plan to weld, gouge and reweld (figure 3) to a back-up strip joint. Since this joint design places the weld root where it will be removed by machining, completely sound metal is assured.

Besides the benefits of advanced product design and cost reductions from increased reliability, the cooperation required between engineering and manufacturing resulted in increased coordination between the two groups.

When changing from a manual welding or brazing job to a semiautomatic or fully automatic setup, the improved process control is not only necessary to accomplish the improvement or make the saving, but the possibilities of better control stimulate thinking for even greater improvements.

On one type of airfoil blade (originally a casting) design was changed to welding, the majority being done with Mig and the rest with manual metal-arc welding.

Further development led to including the erosion wear surface on one side of the blade in the formed skin and using only Mig welding. Thus, the erosion surface became integral with the new blade skin rather than being built up with weld metal.

In initiating these semiautomatic and automatic processes, a process data card, recording the important features of the operation, is very helpful.

A copy is given to the weldor, the foreman, quality control and time study, and one is retained by the welding engineer. These cards not only supplement process specifications, but are particularly helpful in training new personnel.

At present all automatic and semiautomatic operators have been data-card recorded and the system is being extended to many manual arc welding applications.

By setting up definite requirements for joint preparation and by specifying electrode size and type for each operation, substantial savings have been realized in many areas.

For example, 5/16-in. electrodes are now used for welding bearing pedestals instead of ¼ in. Lab tests indicate that the ¼-in. electrodes cost 67 cents per pound of deposited metal, while the 5/16 in. cost 36 cents.

With an annual consumption of 200,000 lb of the former, and an electrode efficiency of 60%, a saving of $3,720 a year could be realized, more than enough to justify purchase of the 500-amp welder required for the change.

From this improved control over metals joining processes, four advantages were realized:

(1) Highly-stressed fan wheels are now possible.

(2) Because of better coordination between engineering and manufacturing, cost reductions are possible by changing to welded design.

(3) Development of these controls has made possible the use of more fully automatic processes.

(4) In the study of everyday applications of non-critical manual arc welding, attention to process control has led to evaluation and establishment of processes and electrodes best suited for each job.

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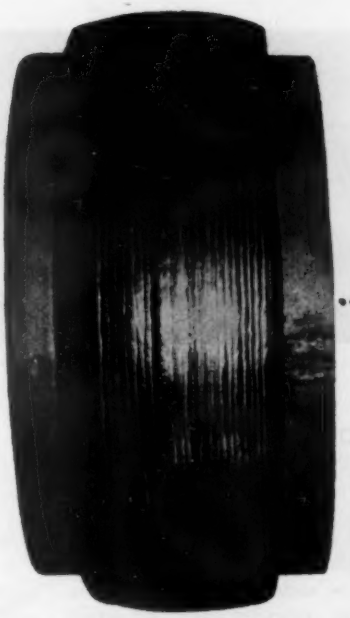
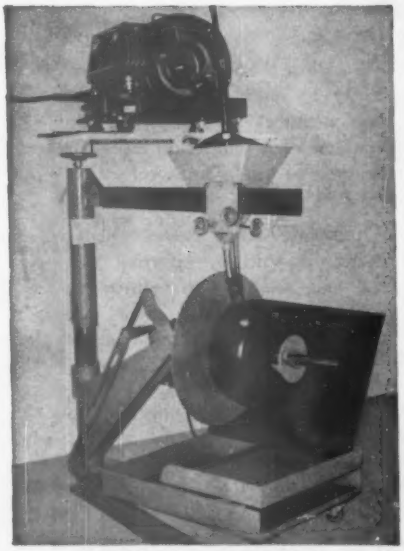


Shovel roll as rebuilt with Stoody wires.



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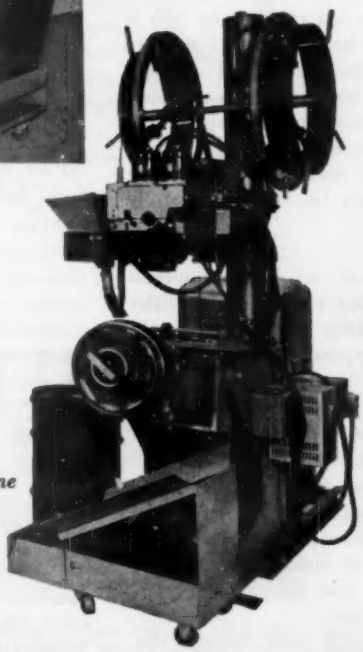

Automatic welding machine rebuilding a shovel roll.

Typical manual semi-automatic operation, open arc.

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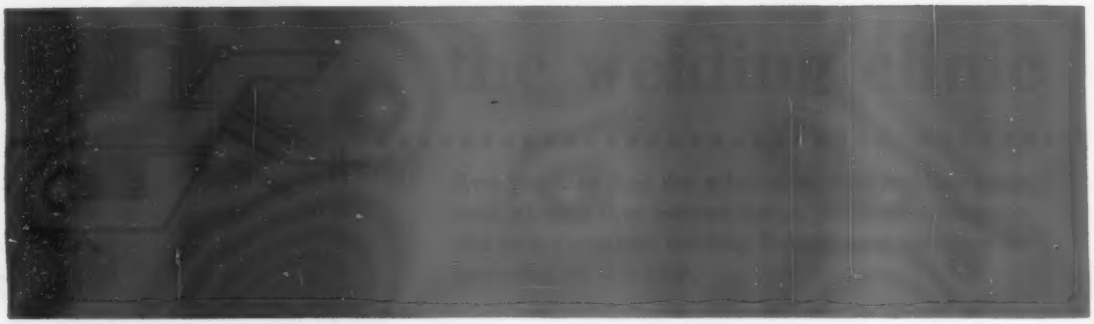

More on weld repair of cracked tools

In the July issue of WE, *The Welding Clinic answered a question on welding procedures for repairing cracked tools. Patrick S. Doyen, general sales manager, Welding Equipment & Supply Co., Detroit, disagreed with these procedures as suggested by Bethlehem Steel Co. Here are Doyen's recommendations. — Ed.*

I can not agree with the answer supplied to a question published in WELDING ENGINEER regarding good welding procedure for repairing cracked dies and other tools, although some of the steps suggested were absolutely correct.

On an over-all basis, the procedures outlined requiring complete heat treatment were too involved and would be too costly for most manufacturing concerns to consider.

First, all tools and dies should be divided into two categories. Tools are usually thought of as broaches, reamers, drills, etc. and normally are made from high speed tool steel only.

Dies are in an entirely different category, as they can be made from any one of the basic type tool steels (i.e., water hardening, oil hardening, air hardening, hot work, and high speed steel).

Many times they are made from special alloy steels, or perhaps are cast from any of the high strength cast alloys on the market, such as Ductile Iron, Meehanite, Strenes Metal, etc.

In any case, it is never necessary to anneal a tool steel unit in order to weld it, unless machining is required after welding is completed. The basic steps for repairing cracked dies are as follows:

1. Determine what type of tool steel is involved.

2. If a die is cracked on one side only, grind to the bottom of the crack. This should be a U-shaped groove, not a vee.

If the tool is completely broken in two, grind 1/3 the thickness of the unit on each side, leaving 1/3 in the center for alignment.

3. Preheat the unit to be welded according to the type of tool steel it is. This can range from 350 F for water hardening tool steel to 1,000 F for high speed and hot work tool steel. A preheat furnace is the best method. However, if a furnace is not available, a preheat torch and heat determining crayons can be very successfully utilized.

4. Choose a special nickel-chrome alloy electrode as a filler material. After each bead of weld metal is applied to the bottom of the crack, the weld deposit should be peened thoroughly. It may be necessary to use a caulking tool to get into the cracked area.

If the unit being welded is one that has been broken completely in two, reverse the unit and apply one layer of weld metal on one side, then one on the other, to utilize stresses.

If the crack runs through the cutting edge or working area, stop using the filler electrode 3/16 in. from the completion of the surface of the die and then use a tool steel electrode to match the type of steel involved.

5. Allow the welded unit to cool slowly to room temperature, and then postheat or temper at the recommended tempering range for the type of tool steel involved.

Repairing high speed cutting tools is an entirely different subject, and welding procedures are much more technical. The procedures as outlined for dies could be followed as basic steps, particularly on heavy units. However, great care and caution must be exercised when cutting edges are involved.

The actual cutting edge should be welded with an inert-gas shielded arc, since the manual metal-arc weld deposit is seldom acceptable.

Many high speed cutting tools particularly broaches, can be very successfully silver soldered. Procedures and equipment needed for successfully silver soldering all types of tools is a subject too lengthy to present here.

The Editors will make every effort to answer all questions submitted to this department. If you have a question concerning welding or related processes — or a tip you would like to pass along to other readers — send it to The Welding Clinic.

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For more facts Circle No. 167 on Reader Service Card

Oxygen is neither combustible nor explosive; often miscalled

by **F. C. Saacke***
Safety Director
Air Reduction Co., Inc.

OXYGEN IS OFTEN MISNAMED a combustible, even an explosive, because it supports combustion.

Much of this confusion stems from careless terminology practiced by many oxygen manufacturers and compounded by its users.

Similarly, many materials, because they are not flammable in air, are called "fire resistant," which is not correct when the material is used in oxygen.

The fire-triangle shows that an ignition source is needed as well as fuel and air to develop a fire. Air's oxygen supports combustion, so the word oxygen could be substituted.

But when fuels burn in air, there are approximately four volumes of nitrogen (79%) that are heated with each volume of oxygen (20.9%) consumed in the combustion reaction. Without this heat absorber, the reaction temperature would increase markedly.

Thus, the first significant difference between combustion in air and in oxygen is: the reaction temperature of a combustible material is higher in oxygen than in air.

With these high reaction temperatures, many materials and metals that do not burn in air will burn freely in oxygen. For example, an hydraulic oil designed to resist fire in air may be unsuitable under oxygen pressure; or an oxidation resistant air compressor lubricant may be dangerous in oxygen compressors or handling equipment.

Many metals that oxidize with extreme slowness in air can burn readily in oxygen. For example, most flash bulbs today are filled with aluminum wire (not magnesium) with oxygen under pressure. A short resistance wire is placed between the electrical terminals as an ignitor.

By puncturing the flash bulb and clearing the atmosphere with your breath, you create an air atmosphere around the aluminum wire. Then, with a 1½ volt battery connected to the terminals, only a slight glow develops at the resistance wire, indicating aluminum wire does not burn in air.

However, puncture another bulb to reduce oxygen pressure to atmospheric pressure (but not clearing the oxygen). The aluminum wire will burn brilliantly and rapidly in the pure oxygen.

This illustrates the second significant difference: many materials that are not combustible or that are fire resistant in air will burn readily in oxygen.

A report of an industrial fatality some years ago shows graphically the importance of following instructions and safe practices.

Two weldors working in a tank were badly burned. Because of the confined space and close atmosphere, one weldor had asked for air. The helper who had been carelessly calling oxygen "air" made the fatal mistake of pumping oxygen into the enclosure. When welding started, their clothes flared into flames.

Information compiled by the Navy indicates that even a small amount of oxygen accelerated combustion of burnable materials. When air's oxygen content increases from 21 to more than 39%, sparks and flame cause "instanteous ignition" in wool, cotton or denim clothing.

Because liquid oxygen is being used more and more, it is equally important to understand the nature of its combustion reaction.

One cubic foot of liquid oxygen at its boiling point (—297 F. and 14.7 psia) will vaporize and expand to 860 cf of gaseous oxygen at 70 F and 14.7 psia. Thus, concentration in the liquid state is 860 times that of its gaseous state at the same atmospheric pressure.

But because only 20.9% by volume of air is oxygen, the concentration of oxygen in liquid oxygen is 4,100 times that in air.

The rate of combustion reactions involving liquids or solids in air will vary with the nature of the fuel and its surface area. The greater the surface area exposed to air, the easier it can find oxygen and burn.

Finely divided materials, such as oil sprays, cotton curtains, excelsior, all burn far faster than an open pan of oil, a tarpaulin or a block of wood. In liquid oxygen, most materials are porous or cracked solids due to freezing and severe shinkage.

Consequently a high surface area is exposed to these usually

* Condensed from a paper presented at the National Safety Congress.

high oxygen concentrations. On ignition, the combustion reaction is very rapid and the available heat of combustion is generated almost instantaneously, resulting in either violent combustion or detonation.

Because combustion of fuels in liquid oxygen permits the quick release of most of the available energy, liquid oxygen has been used for years as one component of "safe" explosive for blasting.

Cotton bags containing fine carbon when soaked in liquid oxygen could be used in place of dynamite by detonating with a blasting cap. In the case of a misfire, the "explosive" would soon revert to inert carbon as the liquid oxygen evaporated.

This liquid oxygen explosive was called LOX and the name copyrighted. Unfortunately, the name has been borrowed by many in the industry who want to describe liquid oxygen (LQO). Thus, many mistaken notions of liquid oxygen's potentialities were created.

True, liquid oxygen can make a carbonaceous material burn explosively, but so can air if the material is powdered. Liquid oxygen by itself is inert.

Here are the five points to remember:

1—Oxygen supports combustion in combustible materials; it does not burn and is not combustible by itself.

2—Oxygen should never be called air; confusion could be fatal.

3—Fire resistance describes combustion characteristics in air. In pure oxygen many non-combustible and most fire resistant materials can burn readily, including most powdered metals.

4—In pure oxygen a spark can cause immediate and flaming combustion of clothing and fuels.

5—LOX is a tradename for a liquid oxygen explosive, and should not be used to describe liquid oxygen, a non-explosive.

Most fires and explosions cannot occur without air — yet we do not call air a fire hazard or an explosive. Be equally careful about gaseous and liquid oxygen so that the fuels or ignition sources that can cause a fire or explosion will be more readily recognized and guarded against.

Environment, space are safety, factors in locating an oxygen plant site

by **F. Himmelberger***
Director of Safety
Air Products, Inc.

LOCATING AN OXYGEN PLANT is not much different than buying a lot to build a home.

Cost of land, taxes, etc., are all important factors. But just as we are concerned about the health and welfare of our families, we want a safe plant for personnel and one free from operating interruptions due to accidents.

The key to safety rests in careful consideration of environment and space.

Since air is the raw material for an oxygen plant, its purity is an important environmental factor. Atmospheric contamination is not readily predictable, but by studying the properties of contaminants, their sources and their distribution in the atmosphere, practical decisions can be made in determining the location's suitability.

Of greatest concern are contaminants which are combustible with oxygen, and particularly those which have certain physical properties similar to oxygen, enabling them to penetrate into oxygen-rich portions of the system.

Air pollution can come from a number of sources: vents, stacks, flares, disposal areas and process leaks. Knowledge of sources, present and future, should be collected and displayed on a sketch of the proposed plant and its surroundings within 1,000 ft.

Location of all stacks and flares and other possible contributors to air pollution should be marked, showing approximate elevations and composition of effluent gases. Also included should be a map showing possible contamination within a mile radius.

Within the proposed plant area or very close to its surroundings, the possibility of process leaks warrants careful attention. In many cases it is necessary to re-route process lines, since a major leak close to an air intake can be more critical than a generally poor atmospheric condition.

Elements of doubt are covered by adding safety features in the plant cycle or by remote location of air intakes or relocation of vents and stacks which contribute to atmospheric pollution.

Persistent safety problems and a rash of minor accidents can result from attempting to build a plant and to do business from a site which is too small for the purpose. Housekeeping invariably suffers, and poor housekeeping is often related to congestion — both breed accidents.

Space factors of most importance are: storage and housekeeping; operation and maintenance; product storage and transfer; internal traffic problems and future expansion.

To balance all the factors, both economic and safety, a level of safety must be defined which is constant from one location to another. Adapt the plant to the site to provide:

1—Personnel safety, at least a little better than industry standards.

2—Reasonable freedom from operating interruptions due to accidents.

3—Immunity from persistent safety problems which foretell minor hazards as well as continuous expenditures.

* Condensed from a paper presented at the annual International Acetylene Association convention.

NEW set-up for fabrication of cab doors makes use of the brazing process with flame-fluxing. Doors were previously oxyacetylene welded.

Brazing produces smooth surfaces for cab doors

by George A. Medsker

CAB DOORS ON HEAVY TRUCKS must absorb plenty of punishment when the trucks are on the road. This makes weld quality a prime consideration.

High joint-strength, freedom from brittleness in or near the joint, and smooth surfaces are required in fabricating these doors. For some time the Orrville Metal Specialty Co., Orrville, Ohio, obtained tolerable results with the oxyacetylene process. One drawback, however, was the usual unevenness in the weld surface, which made it necessary to solder over the weld in order to achieve a surface smooth enough for finishing.

Joints involved in the door assembly are of the butt type, using 18 gage, SAE 1020 steel. The firm then considered discontinuing the gas welding of these joints, in favor of brazing. A trial run established that brazing enhanced the strength and appearance of the joint, and eliminated the need for a soldering operation.

A flame-fluxing brazing process, with equipment from Gas-Flux Co., Elyria, Ohio, was given a production trial. In setting up for the automatic fluxing method, it was necessary merely to introduce a flux dispenser into the acetylene hose line, between cylinder and torch.

A properly compounded flux, dissolved in a highly volatile liquid, is held in the flux dispenser, which is mounted convenient to the brazing station. When the acetylene gas passes through the dispenser, it picks up and vaporizes the correct amount of flux to suit the work.

Use of too much conventional flux which leaves hard, tightly adherent residues on the work, is eliminated. Also avoided are rejects for high porosity due to the use of too little flux.

No difficulty was experienced in making the changeover because no modification of torches or regulators was needed. Use of the oxyacetylene combination was continued in order to take advantage of its characteristic good heat control and clean flame.

An initial demonstration had shown that with a standard oxyacetylene brazing torch, a braze of much better appearance and greater strength could be produced. In production, a few minutes of schooling enabled the operators to duplicate exactly the brazing results obtained in the demonstration.

Filler metal used is low fuming bronze in 1/8-in. and 3/32-in. sizes. Although this rod is known to be very well adapted to bridging wide gaps, this advantage is not utilized: door assemblies are clamped in jigs to get the best possible fit. A substantial saving in filler rod and brazing time results, but more important is to have the product look and fit better.

Using a nearly neutral flame, the operator brushes the joint to preheat the steel. Flux is applied automatically in this step and a perfect wetting action is observed. When the steel begins to glow,

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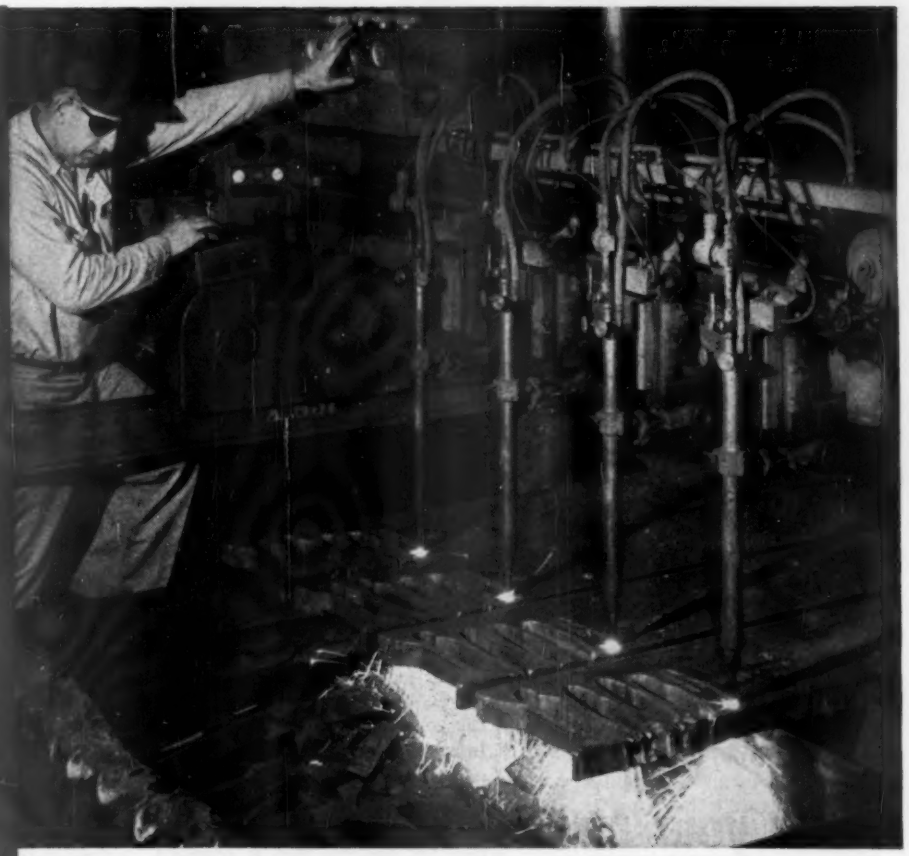

AMF Estimates Messer Statosec Will Pay For Itself In 18 Months!

Yes, American Machine and Foundry, Brooklyn, has achieved results far beyond expectations from the Messer oxygen cutting machine shown here. This *Statosec* unit turns out dies (for cigar wrappers) at a rate far faster than they were formerly produced.

Cost savings are such that the Messer machine can pay for itself in only 18 months—a factor that can contribute substantially to profits.

Don't spend money, make money by installing Messer machines.
Write for details on the complete Messer line.

Messer Cutting Machines, Inc.

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For oxygen, nitrogen, hydrogen, standard nitrogen-hydrogen mixtures, argon, helium and standard argon-helium mixtures

Are you making or repairing construction or farm equipment, automotive bodies, office equipment, air conditioners, building panels, freezers, trailers or any of a hundred other fabricated products with oxyacetylene welding, Heliwelding or Aircomatic® welding? Or are you involved in scrapping or other cutting operations? Your authorized Airco Distributor is your local supply source for the super-pure gases that you need. And when you want that gas *fast*—your Airco Distributor can't be beat for prompt service.

Choose from the **AIRCO** quality line of high purity and rare industrial gases. Also gas welding and cutting equipment—gas-shielded arc welding process equipment—arc welding equipment and arc welders—flame cutting machines—electrodes—supplies and accessories.

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RIGHT — Smooth joint on cab door is now produced by brazing with an automatic fluxing setup. Below — A closeup of the brazed joint.

the operator starts heating the bronze rod to the point where he can flow it evenly over the joint. He is able to work the deposit along the joint without interruption because the flux is supplied continuously through the flame.

If the advance is steady and unbroken, the braze will be smooth, clean and flat, and a minimum amount of filler rod will be consumed. If the advance is fast enough to prevent too high heat input there will be absolutely no porosity.

Shortly after the start of this brazing procedure, shop records indicated that grinding time was greatly reduced. Use of solder as a filler over the former gas weld was eliminated. In addition, aside from the time saving in grinding and soldering, the joint itself is being brazed in much less time than was formerly required to gas-weld it. Daily production now averages about 30 doors per station.

Minnesota bridge submerged-arc welded

by A. Hanson
and W. G. Fess*

LOWER 12-in. flange is submerged-arc welded to 45-ft steel plate haunch girder.

ALONG MINNESOTA'S North Shore drive, overlooking Lake Superior, another giant is rapidly rising in Paul Bunyan land: a four-lane, welded steel bridge for State Highway 61 at Beaver Bay.

St. Paul Structural Steel Co., St. Paul, Minn., fabricated the 286-ft span, Minnesota's first all-welded, steel-plate girder bridge. Chief fabricating problem was to control distortion, while obtaining weld quality and speed. To solve this problem, the company decided on automatic submerged-arc welding.

With the welding equipment mounted on a custom-fabricated track, the St. Paul shop attached 1¼- by 12-in. flanges to the huge web sections, which are ⅜-in. thick and 6¾-ft deep. Girders were fabricated in shop layout with butt and ⅝-in. fillet welds, at a welding speed of 13 ipm. Current was 600 amp at 30 volts.

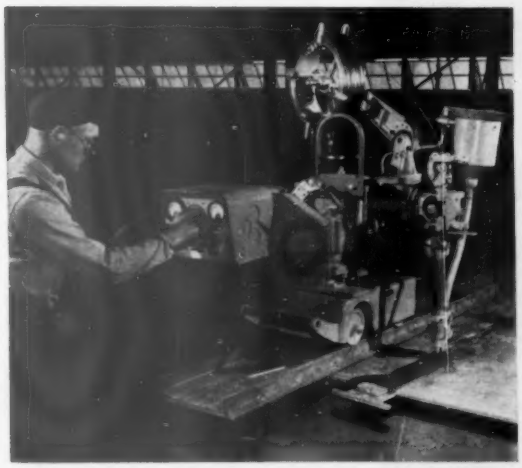
Each girder consists of two 45-ft haunch girders, a 90-ft center span, and two end spans of 63 and 43 ft. The Beaver Bay Highway bridge contains eight such girders, for a total weight of 316 tons. All girders are supported in place by bearing assemblies which allow the structure to move horizontally with expansion and contraction.

All submerged-arc welds were radiographed by the Minnesota State Highway Department, and received 100% approval. The eight 90-ft bridge sections were shipped by rail from St. Paul to Two Harbors, Minn. Here they were transferred to trailer trucks, accompanied by state police escort, for the remaining 25 miles of the trip. Shorter sections were shipped by truck from St. Paul directly to the site.

Submerged-arc welding, with equipment manufactured by Linde Co., New York City, minimized girder distortion. The heavy welding current resulted in maximum penetration, and pinpointed heat in the weld zone.

The high-speed welding carriage kept the electrode moving at a constant rate, thus preventing overheating of the base metal and subsequent distortion. Total fabricating costs were effectively reduced.

*Mr. Hanson is vice president, St. Paul Structural Steel Co.; Mr. Fess is a welding sales engineer, Linde Co.



ABOVE—Automatic unit butt-welds a 12-ton girder. RIGHT—Beaver River rushes beneath bridge as workmen pour concrete piers for northbound span.

AWS keynoter warns of complacency

PRESIDING at opening session was Convention Chairman J. E. Dato (left), Linde Co. AWS President R. D. Thomas, Jr., Arcos Corp., is in center, and C. M. Parker, American Iron and Steel Institute, at right. Parker delivered keynote address.

ABOUT 200 delegates were on hand for opening of fall meeting.

CORRIDOR conversation during breaks. One non-technical topic: the Pittsburgh Pirates, who the day before meeting opened clinched the National League pennant. (Photos by *Welding Engineer.*)

WE MUST NOT LET complacency embrace us, lest we end up a second rate nation.

This warning was voiced by C. M. Parker, American Iron and Steel Institute, who delivered the keynote address at the fall meeting of the American Welding Society in Pittsburgh in late September.

Citing the various differences between the United States and most of the European nations, he said our higher cost of living, including production costs, is the price "we pay to live in this free country under our incomparable Constitution."

The rest of his talk dealt with the status of the steel industry.

An earlier speaker that Monday morning, E. K. Timby, a director of the American Society of Civil Engineers, stated that he felt the acquisition of new knowledge was not our greatest problem, but that the utilization of what we know now is a tremendous problem facing scientists and engineers today.

The fall meeting's technical sessions were well diversified, with all of the joining processes receiving attention. The Structural Division of the ASCE, the Column Research Council of Engineering Foundation and the Society for Nondestructive Testing joined AWS in sponsoring some of these sessions.

The 51 papers covered areas of research as well as actual joining applications in manufacturing.

Replacing the usual president's reception at the fall meeting was a luncheon on Tuesday. Guest speaker was W. W. Sproul, Jr., vice president, General Products Div., Westinghouse Electric Corp.

The plant tour was a combined one of the Ambridge, Pa., plant of the American Bridge Div., U. S. Steel Corp., and the Shippingport Atomic Power Station of Duquesne Light Co.

Many of those who took the tour expressed chagrin over the fact that most of the fabrication they witnessed at Ambridge was *riveted.*

Liquid fluxing eliminates stains

DISCOLORATION on brazed copper and copper-base alloys can be eliminated by a liquid flux applied through a gas torch.

Lennox Industries of Marshalltown, Iowa, found a system that avoided discoloration—produced by oxidation of the heated metal—by metering a liquid fluxing agent into the acetylene or propane gas.

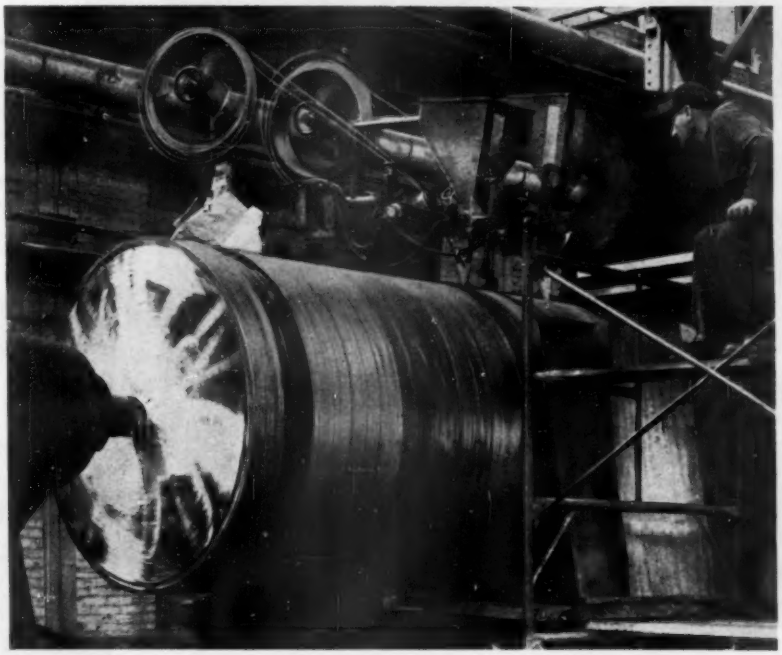
The material, manufactured by All-State Welding Alloys Co., Inc., White Plains, N. Y forms a protective coating over the heated metals, obviating oxidation and lowering the amount of gas needed.

Welder uses liquid flux system in assembling expansion valve and distributor.

In operation, the fluxing agent is vaporized by a single automatic dispenser and introduced into the welding-gas line between the gas cylinder and torch. Gas flows through a metering tube and bubbles up through the liquid flux carrying the flux to the flame.

SAMPLE tubing on left was brazed using manually applied paste solder. Sample on right was brazed with bare bronze rod and liquid flux.

About two additional pounds of acetylene on the tank gage are needed to push the gas through the liquid. The liquid flux is especially suited to brazing carbon and low alloy steels, cast iron and brass and copper-base alloys.



Long-life overlay

. . . 5,000 FEET OF IT!

Typical AMPCO-TRODE® application with submerged arc or MIG

To protect against wear caused by sliding friction — to get years of extra service—this 7,500-ton forging-press ram was overlaid with Ampco-Trode 10 bare wire. Two submerged-arc heads were used, instead of one, to double the rate of deposit.

There are three Ampco bronze electrodes especially suited for automatic welding processes: *Ampco-Trode 10, Ampco-Trode 160,* and *Phos-Trode.* They give you a range of deposit hardnesses resistant to sliding wear, shock, squashing out, erosion, cavitation-pitting, and corrosion.

All are available also as bare and coated filler rods. Ask your Ampco distributor to recommend the Ampco-Trode that is right for you. Send coupon for bulletin. Do it today.

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AMPCO METAL, INC.
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Bare wire available in coils and level-wound spools

AMPCO METAL, INC.
Dept. 186K, Milwaukee 46, Wisconsin

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W-185

CAST steel blades are welded to a rolled steel band and cast steel crown to form the first hydraulic turbine runner for the Oahe Reservoir project being installed by Allis-Chalmers Mfg. Co., Milwaukee. Areas on the back surface of blades were overlaid with stainless steel with medium strength, low-hydrogen electrode to reduce pitting.

On the job...

BATTERY of clamps ties together 300 condensers in a research program seeking to duplicate the sun's source of energy, atomic fusion. The supporting sections of the clamps were constructed by silver soldering a slotted cylinder to the flange of a formed bracket. Welding ground clamps for the condenser sections were made by The Lincoln Electric Co. of Cleveland.

FORGING of alloy to be used in 22,000 kw gas turbine for the Philadelphia Electric Co. is tested ultrasonically before final machining and assembly by Westinghouse Electric Corp., Pittsburgh. The one-piece forging is 44 in. in diameter, 10 in. wide at its thickest section and weighs over 5,000 lb.

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4609.1

LINCOLN WELDERS

three phase rectifier ***IDEALARC R3M®***

DC arc welders

Announcing a new family of ***LINCOLN WELDERS***

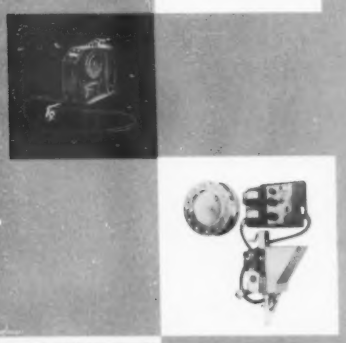
. . . full range of sizes, 300 amp to 650 amp

. . . generous capacity in each size

. . . ideal arc characteristics

. . . rugged, maintenance-free, construction

. . . surprisingly low price



IDEALARC
R3M-400
LINCOLN
WELDER

A great new addition to the World's Most Popular Line of Welders

Lincoln's all new
IDEALARC R3M

three phase rectifier DC arc welder

With such a large group of Lincoln welders already available to meet the needs of welding users, you might wonder why the new Idealarc R3M is necessary. Here is the reason—on some applications the following are either necessary or highly desirable:

1. DC welding current for small sized electrodes or stainless steel, alloy, non-ferrous or other special electrodes.
2. A current range broad enough to handle both semi-automatic equipment and small manual electrode.
3. A balanced, three phase input current.
4. Quiet operation.
5. Low idle currents.
6. High power factor and efficiency.

Only in a three phase rectifier, such as the new Idealarc R3M, can all these features be incorporated into one machine.

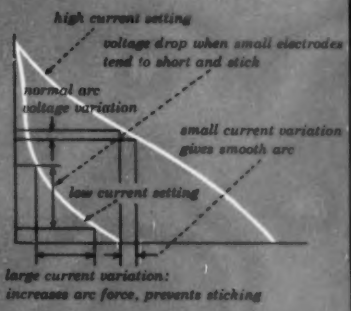
In addition to these features, the rugged construction of this new Lincoln welder promises to set new high standards of trouble-free operation and minimum maintenance. The highly efficient silicon rectifiers do not age or deteriorate and are exceptionally well protected against overloads with special electrical circuitry.

APPLICATIONS

For Manual Welding—The Idealarc R3M will handle *any* manual electrode. Its output characteristics produce smooth, steady, spatter-free welding at high currents and strong current surges that prevent sticking at low currents. In the production plant, maintenance shop, or the construction site, your operators will enjoy using the Idealarc R3M.

For Semi-Automatic Welding—The larger sized Idealarc R3M's, equipped with the optional "Power Pack", can be used as a power source for Lincoln's submerged arc Squirt Welders or other semi-automatic equipment. Equipped with two sets of leads, one Idealarc R3M can be used alternately for both manual and semi-automatic welding—double duty for added versatility and reduced capital investment!

PERFORMANCE FEATURES


high current setting
voltage drop when small electrodes tend to short and stick
normal arc voltage variation
small current variation gives smooth arc
low current setting
large current variation: increases arc force, prevents sticking

Output Characteristics—Idealarc R3M has unique and important built-in characteristics that make welding easier.

First, to prevent sticking with small electrodes, the machine produces a surge of current as arc length is shortened. This surge, seen as the "toe" of the low current settings curve, eliminates the need for separate switches and circuits to prevent sticking.

Second, for smoothest operation of large electrodes, the output curve at high current settings is quite flat and relatively unaffected by arc length variations. There is minimum spatter and "wild arc" action.

Third, for maximum arc stability, R3M's choke coil is designed so that any electrode can be run at any appropriate current, using any technique, with complete freedom from pop-out.

Input Power—The Idealarc R3M draws a balanced three phase current from the lines. Particularly important where machines are installed on existing lines, this characteristic usually permits direct replacement of obsolete welders with new Idealarc R3M's without installation of additional wiring, switches or fuse boxes.

Starting and idle current on Idealarc R3M welders is practically nil, amounting to less than 15% of the rated input current. On field applications, the number of machines which can be powered by one generator set depends only on usable rated current, not starting current.

Power factor is high and idle amps low on the Idealarc R3M. Efficiency is excellent. Overall, for machines operating at rated load, efficiency is about 75%. Note that the silicon rectifiers contribute considerably to this. They are about 4 times as efficient as selenium rectifiers.

You'll find the Idealarc R3M welder truly ideal from the standpoint of every input power consideration.

Low Cost—After you've checked the performance and construction features of the Idealarc R3M and convinced yourself that it is tops in its class, then look at its price. You'll be pleasantly surprised.

LINCOLN IDEALARC R3M
Three Phase Rectifier, DC Arc Welder

CONSTRUCTION DETAILS

Current Control — An easily turned crank on the front of the machine provides continuous current control over the entire range of the machine by a movable core in the reactor windings. The mechanical system used to move the core is rugged, noise-free, smooth and free of creeping problems.

Polarity Switch — Durable, silver-plated contacts with sturdy mechanical construction assure thousands of trouble-free polarity changes.

Case — The recessed front prevents damage to external controls. Output studs are recessed even further and separated to eliminate accidental shorts. Strain relief loops prevent needless wear on output studs and loose connections that dissipate output and cause operator annoyances.

Lift Bail—Whether you move your machine once or hundreds of times, the convenience of the sturdy lift bail will be apparent. Welded directly to the sturdy frame of the machine, the lift bail is attached permanently regardless of how severely it is used.

Signal Light — Red light indicates machine is on; prevents accidental idle operation during non-working hours.

Line Contactor Starter and Overload Protection —Operated by a push button on the front panel, a heavy duty magnetic contactor energizes the machine. Protective circuits automatically disconnect the welder from the line in the event of overload, overheating from any cause, or input power failure. This well-proved protective system makes it virtually impossible to burn out the Idealarc R3M.

Weatherproofing — Louver design prevents entry of rain, or other falling liquids, into the machine. Also, electrical parts receive a double dip in a special insulating material after they are assembled and interconnected to repel the attack of salt air or other corrosive atmospheres.

Silicon Rectifiers — After years of testing, Lincoln engineers are convinced that the silicon diodes and circuitry employed in the Idealarc R3M provide unequalled rectifier performance and life. To the well-established efficiency and freedom from aging of silicon diodes, Lincoln has added exceptionally large safety margins and unique protective circuits to overcome the problem of overvoltage failures that plagued silicon rectifiers in the past. The results are outstanding.

Windings — Most of the windings in the Idealarc R3M are aluminum, which permit a compact, lightweight design. As in other Lincoln welders the aluminum-copper connections are flash-butt welded and sealed forever in a protective coating. There are no mechanical aluminum-copper joints.

Fan and Cooling System — A large fan moves generous quantities of cooling air through the machine. Clean air flows in at the top of the welder, passes first over the rectifier heat sinks, then down over the windings, and exhausts through louvers in the front panel. A large safety factor in temperature rise, designed in the machine, permits the use of the Idealarc R3M on even unusually severe applications.

SPECIFICATIONS

Idealarc R3M

Model / Type	60 cycle / 50 cycle	K-1149 / K-1153	K-1150 / K-1154	K-1151 / K-1155	K-1152
NEMA Rating:	Current	300 amps	400 amps	500 amps	650 amps
	Arc Voltage	40 volts	40 volts	40 volts	40 volts
	Duty Cycle	60%	60%	60%	60%
Current Range		30-375	40-500	50-625	65-750
Input Power:	Voltages*	208, 220/440, 220/550 volts			208 220/440
	Cycles	60 and 50			60
	Phase	Three Phase			Three Phase
	Rated Current (220 volts)	58 amps	75 amps	94 amps	120
	Idle Current	9 amps	11 amps	13 amps	13
	Power Factor @ Rated Load	74%	76%	75%	74%
Weights (Approx.):	Net	586 lb.	675 lb.	800 lb.	910 lb.
	Domestic Shipping	650 lb.	739 lb.	864 lb.	974 lb.
	Export Shipping	731 lb.	820 lb.	945 lb.	1055 lb.

Dimensions (all types)	Height	Width	Depth
Machine, overall	39⅞"	26⅛"	28½"
Export Crate	55"	36"	36"

*220/380 and other single voltages available on special order

OPTIONAL FEATURES

(at slight additional cost)

Undercarriage—provides portability. A sturdy three-wheeled undercarriage with either steel (K-726) or solid rubber tires (K-726R) is available for field installation.

Remote Current Control — Changes machine current setting from the operator's station with a simple toggle switch. The switch operates a motor inside the welder case which rotates control crank to adjust current up or down. Available factory-installed only.

ML-2 Power Pack—provides 115 volt DC control power and other circuits necessary for Lincoln ML-2 Squirt Welder. Available as a kit for field installation.

115 Volt Starter Circuit—for plants with regulations requiring 115 volts on starter push button circuits. Available factory-installed only.

Accessory Kit — includes headshield and lenses, electrode holder, ground clamp, and cables. Priced below total price of individual components.

Remote Polarity Control — Change from DC (+) to DC (—) or vice versa, with a switch attached to the electrode holder or mounted at the operator's station.

THE LINCOLN ELECTRIC COMPANY
Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment and Electrodes.

LINCOLN ...USA

TRADE NAMES* OF ELECTRODES AND COMPARABLE AWS-ASTM DESIGNATIONS

AWS Classification	E 4510	E 6010	E 6011	E 6012	E 6013	E 6014	E 6016	E 6018	E 6020	E 6024	E 6027	E 6028
General Description → MANUFACTURER	All Position DCSP	All Position DCRP	All Position DCRP or AC	All Position DCSP or AC	All Position DC or AC	Iron Powder All Position AC or DC	Low Hydrogen All Position AC or DC	Iron Powder All Position DCRP or AC	H-Fillet or Flat AC or DC	Iron Powder H-Fillet or Flat AC or DC	Iron Powder H-Fillet or Flat AC or DC	Iron Powder H-Fillet or Flat DCRP or AC
Air Reduction	41 or 63	78, 78E, Easyarc 10	230 Easyarc 11	323 or 387	90, 90A, 90B, or 90C	Easyarc 14	312	Easyarc 328	81, 315 or 306	Easyarc 12	Easyarc 30	LH 716
Canadian Liquid Air	SC-15	LA 6010	LA 6011P	LA 6012	LA 6013	LA 6014	LA 7016	LA 7018	LA 6020			LA 6024
Harnischfeger	Washcote	AP, AP-100	AC-1	PFA, WE-8	AC-3, SW	DH-6	70 LA-1 70 LA-2	170LA	DH-2 DH-3	DH-5	DH-27	DH-170
Hobart	Sulkote	10, 10 ip	335	12, 212, 12-A	413, 447, 13	Rocket 14			111	Rocket 24	Rocket 27	
Lincoln	Stable-Arc	Fleetweld 5 5P	Fleetweld 35 180	Fleetweld 7, 72, 7MP	Fleetweld 37 Planeweld 2	Improved Fleetweld 47		Jetweld LH-70		Jetweld 1	Jetweld 2	
Marquette	101	105	130	120	140, 151				115			
McKay	21	15, 15D	11	116, 17 6012HS	24	6014			16	Comet arc		
Metal & Thermit	Sulcoat	Type R Speedex	Type A 611-B	Genex M Genex, N13	Type U, U-13 Alternex	Speedex-U	Type HTS		Type FHP Type HF Type D Fillex	Speedex	Triplex	
National Cylinder Gas	Sureweld 30-S	Sureweld 6010-C	Sureweld 6011A	Sureweld 6012, 6012-C	Sureweld 6013, 6013A, 6013B	Sureweld 6014		Sureweld 6018		Sureweld 6024		
Pacific Welding Alloys	E 4510	E 6010	E 6011	E 6012	E 6013	E 6014	E 6016	E 6018	E 6020	E 6024	E 6027	E 6028
Reid Avery	Raco Blue Label	Raco 6010 6010 P	Raco 6011 6011P	Raco 6012G 6012F	Raco 6013	Raco 6014	Raco 6016	Raco 6018	Raco 6020	Raco 6024	Raco 6027	
Shober Sales		32	11, 33	34	35	14				36		
A. O. Smith		SW 10	SW 14	SW 11, 12 17, 29	SW 15, SW 16	SW 15P	SW 65	SW 17	SW 35, 37	SW 44		
Victor		VW-6010A Rapidarc 6010	VW-6011A, 6011B	VW-6012A, 6012B	VW-6013A, 6013B, 6013D	Rapidarc 6014	VW-6016A		VW-6020A 6020B 6020D	Rapidarc 24	Rapidarc 27	
Westinghouse	Sulcoat 18	XL 610, 610A	ACP 611	FP-612 FPZ-612 AF	SW 613 SW2-613 SW3-613	Zip 14	LoHZ-616	Wiz-1B	DH-620, A 13	Zip 24		

*Trade name or Type No. is usually prefixed by company name.

BRAZE BETTER!

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AIRCOSIL NO. 18 FLUX with New Formulation

Silver alloy brazing turns out better when you use new *Aircosil No. 18 Flux.* Won't break down under long heat cycle up to approximately 1450°F. Chemicals stay in suspension, thanks to a new and improved formulation.

Won't spatter. Residue washes off with hot water. Long shelf life, because jar has new cover with flowed-in rubber seal. Supplied in ½, 1, and 5 pound jars; 30 and 50 pound containers.

For highest quality brazed joints on a wide range of ferrous and nonferrous alloys – use new *Aircosil No. 18 Flux.* Immediate delivery and complete information from your nearest Airco office or local distributor.

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Divisions of Air Reduction Company, Incorporated
Authorized Distributors in most principal cities
Circle No. 184 on Reader Service Card

WELDOR applying alloy rod to form pad over tooth of core barrel cutter head. Later, tungsten carbide rod is applied for extreme hardness.

Two alloys give cutter head long-wearing teeth

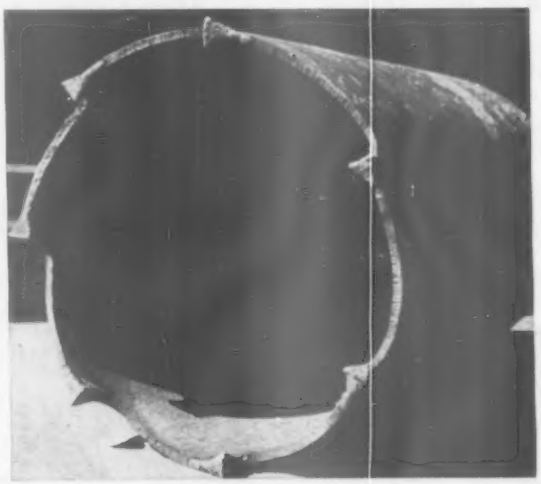
WHEN THE GOING gets rough and standard cutter heads will not drill through rock, hardfacing alloys come to the rescue.

The Atlanta, Ga., branch of the McKinney Drilling Co. found that use of two separate rods provided the results demanded.

A core barrel, sometimes called a caisson-cutter head, is prepared for increased service life in the following manner:

A set of teeth is cut into one edge of the head, about 10 in. apart and sloped in one direction. Using the metal-arc method, the weldor applies rod – in this case manufactured by Haynes Stellite Co., New York City – to form a pad of alloy about ⅜-in. thick over the entire area of the tooth.

He extends the deposit about ¼ in. wider than the wall thickness



CLOSE-UP of finished cutter shows teeth flared outward ¼-in. on each side to offer larger cutting surface and to prevent binding in rock.

of the barrel on each side of the tooth tip; this provides a tooth at least ⅛-in. wider than the barrel wall.

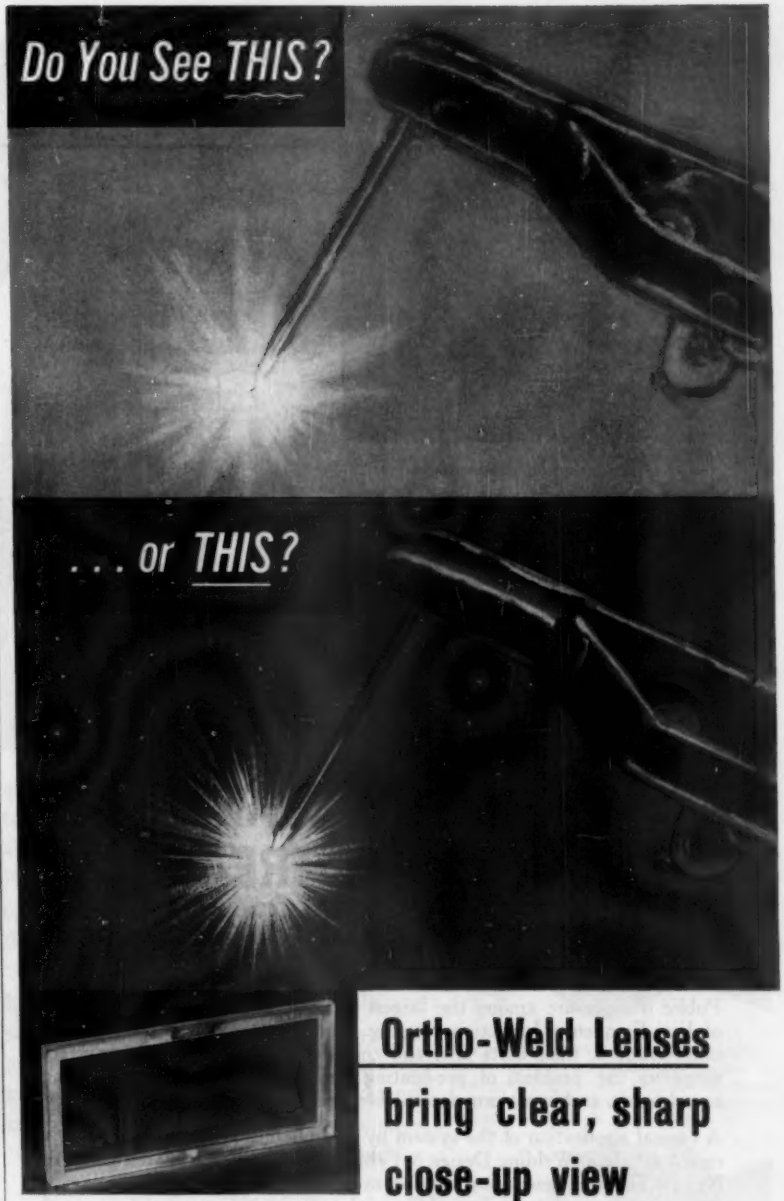
The deposit extends down along the rear slope of the tooth for about 1⅛-in., and for about 2½-in. down the face of the tooth. Then a tungsten carbide rod is applied to the pad of the alloy deposit over the entire tooth.

The hard tungsten-carbide particles are imbedded in each tooth, providing an extremely hard-cutting agent in a softer matrix of the more resilient material.

AFTER pad is in place, tungsten carbide is applied to provide sharp, long wearing cutting edges.

For the McKinney firm, this procedure has led to twice the service life when compared to core barrels faced with other materials. Total service life of the hardfaced core barrels — commonly used in shale areas of Texas and Louisiana—depends on the hardness of the rock being drilled.

A drilling rig handling this tool exerts between 30,000 and 50,000 psi on the core barrel while operating at slow rotational speed. The big drill rigs are used to cut holes for caissons used in construction of large buildings, bridges, and other structures.



Ortho-Weld Lenses bring clear, sharp close-up view

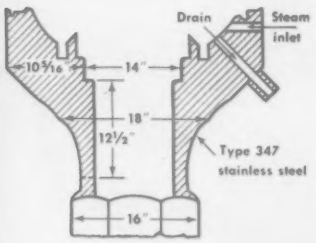
Welders who wear bifocal lenses usually can't see well when the helmet is in working position; either they must work without their glasses, or, with glasses, the near-vision bifocal segment is out of the line of vision.

Ortho-Weld magnifying lenses correct this fault. By bringing work into focus they make operations easier, faster and more accurate.

Molded from crystal-clear lucite, Ortho-Weld lenses are inserted between the filter lens and rear cover plate of the helmet. They're available in 4 powers to fit the needs of most bifocal wearers: plus 0.75, 1.25, 1.75 and 2.25. Lens size is 2" x 4¼" or 2" x 4⅛". For more information, call your B&L supplier, or: Bausch & Lomb, 98711 Lomb Park, Rochester 2, N. Y.

BAUSCH & LOMB

Profit through E.A.I. Research



Uniform, through-and-through heating of the thickest sections of the big stainless steel valves was provided by the Smith-Dolan method, with precision control of temperatures (2-hour dwell at 1900°F.). Drawing shows cross-sectional dimensions.

Standard Smith-Dolan units come equipped with eye hooks and wheels for easy portability, and with instrumentation for recording permanent charts of the heat run.

SMITH-DOLAN On-the-Job HEAT TREATMENT

Solution to Weld Embrittlement Problem at Consolidated Edison

Public utilities are among the largest users of the Smith-Dolan System of Low-Frequency Induction Heating. They want to keep their service uninterrupted, their costs low, and they find that this portable system simplifies the problem of pre-heating and post-annealing in producing sound welds, and in making dependable repairs.

A typical application of the system by a public utility was described in a recent article in Welding Design & Fabrication.* At Consolidated Edison's No. 10 Turbine Generating Station in New York City, two large steam pressure valves made of Type 347 stainless had to be repaired because of weld embrittlement. Removal to the shop for heat treatment would have proved costly and time taking. With the Smith-Dolan portable units, the work was completed on the job within 12 hours.

Learn about the savings and other benefits your company can obtain from the Smith-Dolan System. It is today's most versatile heat treating method, simplifies and upgrades work quality in numerous applications. Write for brochure, "Smith-Dolan System of Low-Frequency Induction Heating."

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For more facts Circle No. 186 on Reader Service Card

For U. S. Marine Corps jet aircraft

PORTABLE aluminum airstrip developed for U. S. Marine Corps has strong surface of alloy 5456 aluminum. Sections are 12-ft-long, 2-ft-wide panels welded by Mig process.

Portable aluminum panels form landing strip

WELDED ALUMINUM panels are converting rough, open country into smooth landing fields for U. S. Marine Corps high-speed jets.

The panels, produced by Fenestra, Inc., Detroit, can be airlifted

by helicopter, or unloaded across a beach, and assembled quickly to form a solid landing strip.

To handle the tactical jets, the firm used sections as the core of a sandwich construction that would provide a strong surface, free of depressions and holes in which engine-damaging dirt and debris could collect.

For greater weld strength in the production models, engineers of Aluminum Co. of America, Pittsburgh — suppliers of the aluminum — suggested enclosing the mat with sheet in aluminum alloy 5456, a member of the highly weldable aluminum-magnesium alloy series. An automatic Mig process was used to join the components.

Feasibility of the design was proved first by tests at Alcoa's research laboratories, and later in a series of controlled field-condition exercises.

Working under tactical conditions, Marines transported and assembled 12 - ft - long, 2 - ft - wide panels to establish an island airstrip. Jets were operating from the strip well within the objective of 60 hours, after the first matting truck crossed the beach.

Each panel has 27 downward curving fingers along one side, and an equal number of slots along the other. The units are joined when the fingers of one are forced through the slots of its neighbor.

The panel is now being adapted to function as a launching pad for tactical missiles.

HERE, strip panels are being Mig-welded in continuous process.

Do YOUR welding helmets help produce more and better welding?

YES!...they do if they're Fibre-Metal's

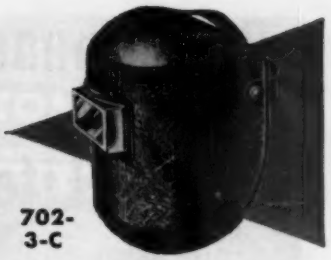
FIBERGLAS* WELDING HELMETS

Undeniable comfort, clearest wide vision and assured safety are basic quality features of these Fiberglas welding helmets. FIBRE-METAL compression-molded, Fiberglas-reinforced polyester resin shells offer the very finest in durable face protection. Proper glass fiber distribution and a "beaded edge for strength" insure long-lasting, trouble-free helmet life. Shells are self-extinguishing, are unaffected by heat and moisture, will not warp or lose shape, may be easily and quickly cleaned and sterilized. *Welders TELL US these helmets help produce more and better welding!*

All helmets have Ratchet Adjustment "free floating" Headgear, impact resistant adjustable friction joints and adjustable chin rest. Glassholders are available in plastic, steel or Dowmetal, in either fixed or lift-front styles. All types of helmets are described in Catalog No. 26.

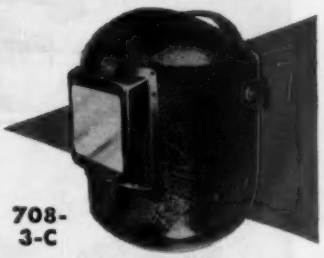
Ask your Welding & Safety Distributor!

*OWENS-CORNING TRADE MARK



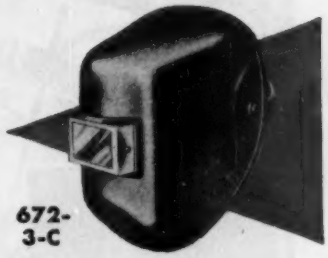
702-3-C

This is a popular standard-size Helmet that offers excellent fume and light seal with extra ventilation. Has all the famous Fibre-Metal comfort features. Offers variety of fixed and lift-front glassholders.



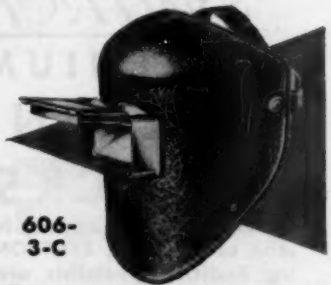
708-3-C

Over 120% increased vision with its 4½" x 5¼" lens...more vision both vertically and horizontally. Reduces eyestrain and fatigue. Excellent for welders who must wear bifocals, or trifocals, while welding.



672-3-C

The popular narrow-front shell for compact, lightweight protection. Best for welding in tight spots...eliminates flat, spatter-collecting surfaces. Less pitting, lasts longer. 674-3-C has lift-front glassholder.



606-3-C

Features extended neck and chest protection with greater ventilation. Standard-size shell. Also available with an Inner Bib *(See our Catalog No. 26)* for extra fume and light seal.

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In CANADA: Fibre-Metal (Canada) Limited, Toronto

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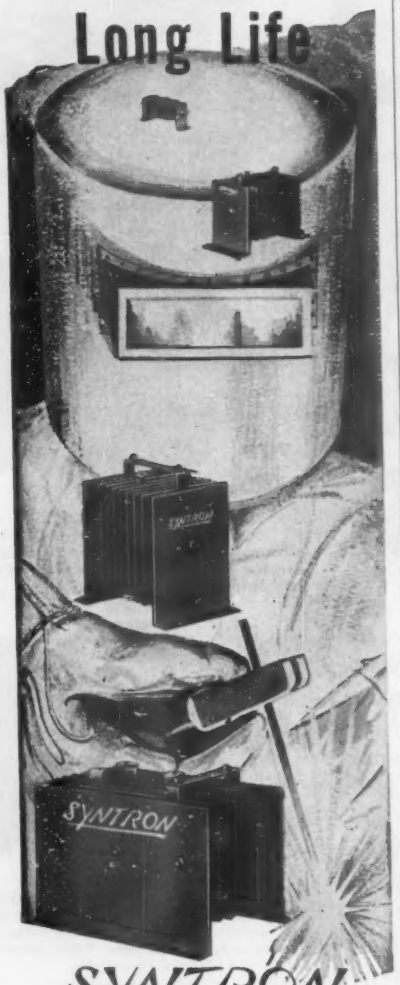

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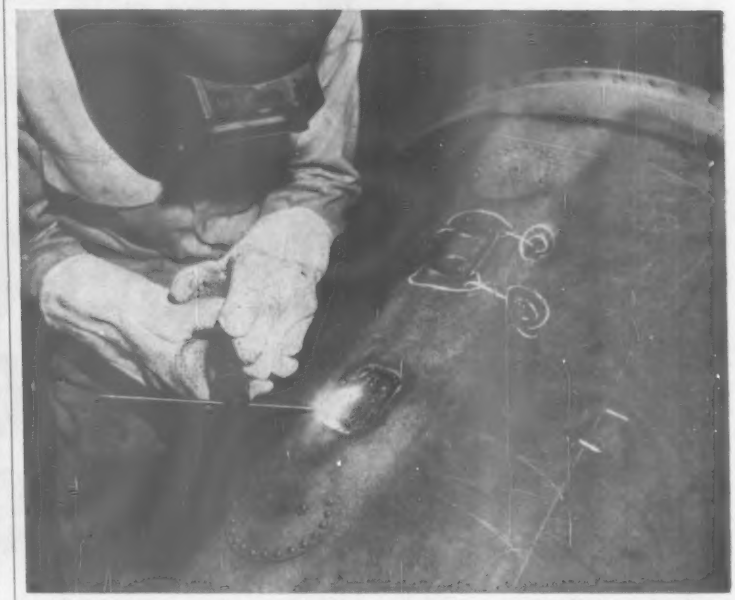
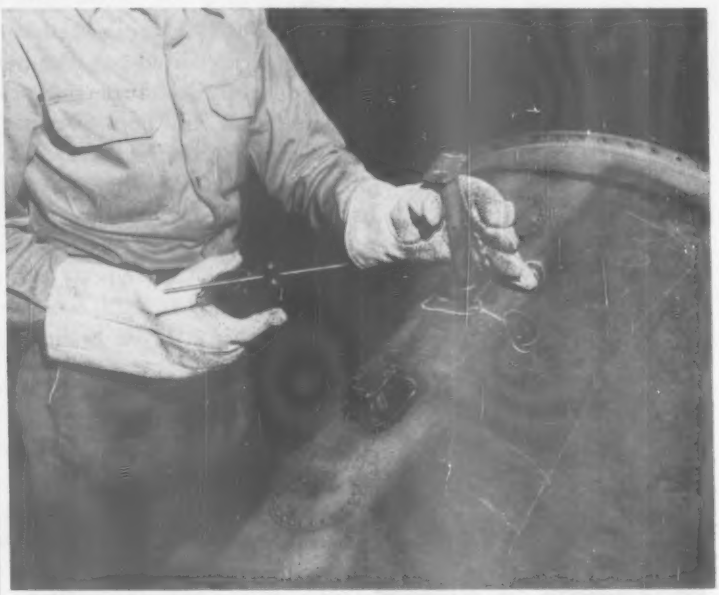
Circle No. 188 on Readers Service Card

Arc-air torch proves economical in weld removal on jet tail cones



OPERATOR uses smallest model arc-air torch with a special 3/16-in. copperclad electrode in removal of support plate weld. Welding current of 200 amp and approximately 90 psi compressed air were employed.



AFTER securing weld on support plates is removed, inside tube is easily extracted. Relatively small amount of required clean-up time added to cost savings.

A DRAMATIC SAVING in time and material costs was experienced by a southwestern machinery firm when it switched to an arc-air torch for metal removal on a tail cone repair job recently.

When Carson Machine & Supply Co., Oklahoma City, Okla., was awarded a contract to modify 10,000 jet engine tail cones, it planned to use special 13,000 rpm grinding wheels to do the job.

The exhaust units were composed of an outer cone and an inner cone held in position on front with stainless steel retainer sec-

tions welded in place. From the sides the inner cones were supported by two stainless steel tubes and rods. These were, in turn, fastened to the outer cone by welded support plates.

Retaining sectors at the front were 0.045-in. thick and were welded to an 0.062-in.-thick part of the inner core. Type 321 and 347 stainless had been used.

Stainless steel is not the easiest material to work, as Carson discovered. More than an estimated quantity of high speed grinding wheels were consumed on the first 700 exhaust units. At this point, Vice President Henry R. Mills decided to use a metal removal torch manufactured by Arcair Co., Lancaster, Ohio.

With power from a 200-amp rectifier, 200-amp reverse polarity setting, the arc was struck with a consumable carbon-graphite copperclad electrode, 3/16-in. diameter, d-c type. Compressed air required was between 80-100 psi.

As the metal in close proximity to the arc was melted, a jet of compressed air parallel to the electrode blew the melted metal away from the work surface. Because the process does not rely on oxidation, it is effective on stainless steel and many other metals which do not oxidize readily.

When the job was completed, Carson found that rework time with the torch process was cut by 93%; there was an 89% savings in materials cost. While the company found these percentages hard to believe, further checking showed the figures to be consistent. They represented the greatest savings the firm had ever experienced.

"Experience?"

By the Manufacturers of Famous

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WORLDS LEADING WELD CLEANING TOOLS

4 NEW ACCESSORIES

To Make The Welder's Job Easier!

FAST DRAW "SAFETY" HOLSTERS

MODEL 19 HOLDS ANY KIND OF HAMMER

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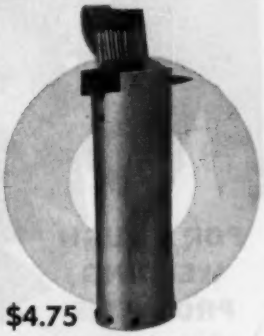
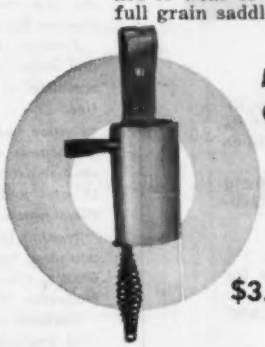
Holster made of heavy full grain saddle leather with belt loop adjustable to 5 lengths. For welders, plumbers, carpenters, millwrights.

MODEL 192 DUAL CASE HOLDS TOMAHAWK & 10 LBS. WELDING RODS

A supply of rods and the Atlas Tomahawk of your choice at your side where you can grab them without even looking. This case has a flat bottom and will stand if you choose not to wear it while working. Heavy full grain saddle leather.



$4.75



MODEL 21 FOR CARRYING ANY COMBINATION WELD CLEANING TOOL

$3.25

Holds Atlas "Dual Tool" or any chipper-brush tool. Protects the welder's fingers and clothing. Prevents brush getting frayed. 5 adjustments on belt loop. Heavy full grain saddle leather.

MODEL 15 SAFETY BELT

Heavy webbing with rust proof ring and snap. Wear it over your coveralls as a belt or shoulder strap to carry equipment.

$2.25

Tough as they come!

Atlas makes 33 different weld cleaning tools. There's one for every purpose and preference—Ask your welding supply dealer to show them to you.

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NEW Complete... Welding Facilities

FOR TOUGH WELDING PROBLEMS

Rosemount Engineering Company announces the installation of a 36" chamber Electron Beam Welder in its Welding Department. REC's certified welding facilities include:

- Electron Beam Welding—from .003" foil to .500" plate —including exotic metals such as beryllium, molybdenum, tungsten and zirconium
- Tungsten Inert Gas Welding
- Metal Inert Gas Welding
- Aircomatic Gun—permits rapid deposits of wire for distortion control
- Stake Seamer—for controlled arc penetration and accurate positioning of parts

WELDING SERVICE AVAILABLE—REC's welding engineers provide consultation and establish welding procedures for difficult problems on an R and D basis. REC's welding facilities are available for production work on an hourly or piece basis. Write, wire or call if we can be of service on jobs requiring broad R and D or production experience.

REC

ROSEMOUNT ENGINEERING COMPANY

4900 West 78th Street • Minneapolis 24, Minnesota

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Reprints from WE

Reprints of certain articles published in Welding Engineer are still available. A list of these appears below. Reprints may be obtained for 15 cents each, except where otherwise noted. Payment must accompany all orders. For quantity orders, write for special prices. Order by title from: Reprint Editor, Welding Engineer Publications, Inc., Box 28, Morton Grove, Ill.

Fundamentals of wear resistant overlay

Explains causes of metal deterioration and how to avoid it and how to select a welding process for hardfacing. This reprint 25¢ each.

Techniques for torch brazing aluminum

Procedures and techniques for brazing aluminum, are detailed. Includes data sheet on brazability of aluminum alloys plus four tables listing commercial products and their characteristics. This reprint is free.

Design for welding

Basic knowledge required when designing, or redesigning for welded construction is detailed and discussed. Sixteen page reprint includes 11 data sheets.

The meaning of weldability

Weldability of carbon steels and alloy steels, as well as some other metals, is discussed. Sixteen page reprint includes three data sheets.

Tungsten inert gas

A 16 page report on the history, theory and application of the Tig welding process. Includes data sheet on proper current selection. This reprint is free.

Welding of dissimilar metals

Complete details on welding dissimilar metals using NiCrFe electrodes and wires. Eight page reprint includes charts on properties, test results and data sheet on properties of other metals.

Acetylene

A 12 page salute to the IAA and acetylene, details the great success of this gas. Includes a history of the IAA and "The Acetylene Journal."

Fixtures for brazing

Presents requirements for designing brazing fixtures and materials to be used. Data sheet on properties of non-metallic fixture materials included. This reprint is free.

Selection, welding of CrMo alloy steel pipe

Discusses determining factors in selection of chromium-molybdenum alloy steels and evaluates the effects of pre- and postheat treatment on weld properties.

Filler metals for joining

Brazing filler metals are detailed and each group is analyzed. Includes data sheet on how to select silver brazing alloys.

Production welding controls

Discusses how material, labor and overhead effect total production welding costs, and how certain controls can result in greater time and dollar savings. This reprint is free.

New aluminum alloy not prone to brittle fracture

Extensive testing of 5083 aluminum alloy proves it has excellent weldability and weld ductility, and a good resistance to corrosion and stress corrosion. Testing for brittleness is detailed. This reprint free.

Explosive welding and forming open another door

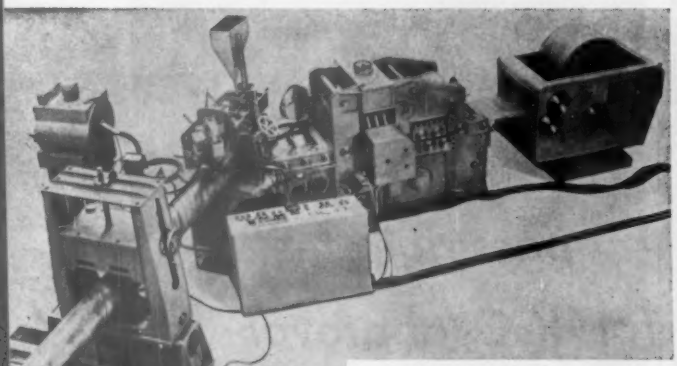
A report on one of the newest entries into the welding industry, and how one pioneer company turned theories and practices into realities.

Our modern-day mythology

A rebuttal to some old-wives tales about the hazards of welding fumes, plus safety recommendations for situations where hazards might develop.

Understanding weld distortion and shrinkage

Causes of distortion and shrinkage can be determined if weld heat is understood. Eleven drawings are used to illustrate this welding problem.



SPIRAL pipe machine manufactures 24 in. by 0.250 in. gas transmission pipe.

Portable mill welds spiral pipe on site

NEW MOBILE MACHINES that can make low cost pipe of any weldable material in diameters from 1/2 in. to 40 in. on the spot were demonstrated recently at an American Gas Association convention, at Atlantic City.

The small and compact mills, built in West Germany for Driam Corp., Manitowoc, Wis., can be trailer-mounted and moved to the pipeline right-of-way to manufacture pipe on a temporary basis.

The machines spirally form and simultaneously weld coil stock or plate into tubes.

Hot rolled steel, down to 16 gage, is submerged-arc welded at the butt seam inside or outside or both inside and outside. Gages of 16 or thinner are resistence welded with an overlap seam.

In thinner gages, the mill can also corrugate the metal in the same pass.

Inert-gas techniques are used for the very small diameter machines, and for very thin materials. In general, any conventional welding equipment and procedures can be applied to these mills.

For applications involving no, or not critical, internal pressure requirements, a single submerged-arc weld is satisfactory.

Sixteen gage and lighter steel is welded with low frequency resistance welding equipment with an overlap seam at speeds of approximately 8 ipm.

Pregalvanized coils can be used and the welding scar eliminated with a zinc metallizing gun.

A production type high frequency welding attachment for the pipe machines in now being tested. Production machines using this technique are expected to be ready in 1961.

Currently, more than 40 machines are in operation in 12 different factories in Europe and Africa, or are under construction in Driam plants. Three machines have been ordered in the United States; two of them are now in operation and the third will be operating early next year.

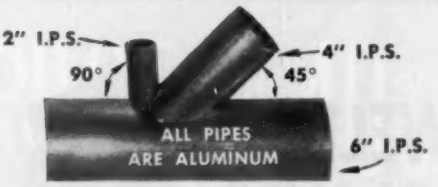
CAN YOU — IN YOUR SHOP — MAKE UP A WELD JOINT?

In less than 2 minutes?

CAN YOU THEN WITH NO DIE CHANGE MAKE THIS SET-UP?...

. . . and have both done in less than 4 minutes?

HOW WOULD YOU MAKE THIS ONE?



You could have made all 3 joints shown in *less than 15 minutes* with your

"De Witt Weld Joint Making Unit"!

You should have one! Investigate!
"How simple!" one customer said.

Ask for Ed De Witt

Phone me today!
Call me collect!
BUCKINGHAM 1-7000

My job is to make your job of weld joint preparation easier.

Or . . . write for a sample. (Tell me what joints you make)

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helps you!

A true handbook to help you select the glove that gives the greatest protection for the longest time. A quick reference to glove styles, details, materials, chemical resistance, etc. Complete with sketches and case histories to increase your knowledge and save your money.

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Horsehide glove shown

... Cool comfort!

Need a rugged glove with lots of finger action? Need extra heat protection? Need a light glove? Doesn't matter ... there's a Riegel Welders glove or mitten just for you. Finer gloves at competitive cost: special tanning, seamless back, wool lining, and welted seams. To help select the *right* glove for your job, write for

FREE GLOVE GUIDE
A wealth of information: styles, types, materials, chemical resistance, case histories, and more.

WRITE: GLOVE DIVISION
RIEGEL TEXTILE CORP.
Conover, N. C.

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For liquified petroleum gas . . .

Welded cylinders pass rigid tests for ICC approval

OVER A MILLION liquified petroleum gas cylinders are produced in the United States every year to serve rural homes, poultry and livestock buildings, tractors, truck fleets, automobile fleets, and even fleets of engine driven arc welding machines.

A lot of cylinders? The LP gas industry has shown an annual increase in sales for 27 consecutive years and the need for cylinders will continue.

The Lee Cylinder Div. of Converto Mfg. Co., Cambridge City, Ind., is one of the largest producers of LP cylinders with one of the better systems for quality control.

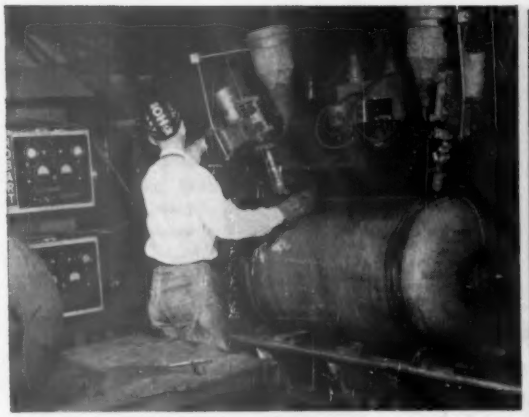
CYLINDERS filled with water are put under 480 lb of internal pressure. Recording instruments indicate drop in pressure, make permanent record of test.

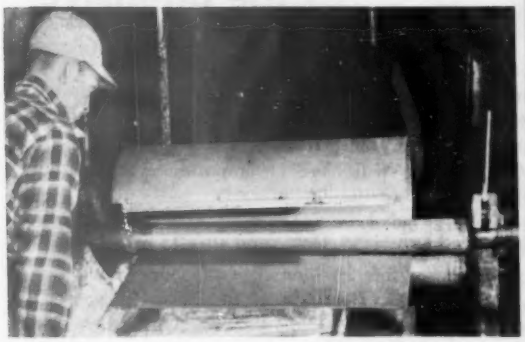
Because these cylinders are continuously crossing state boundaries with highly volatile contents, the Interstate Commerce Commission has set up rigid specifications for strength and performance of materials used in making them.

Lee cylinders are made from easily brazed or welded high strength steel, meeting ICC requirements of 70,000 lb psi minimum ultimate tensile strength plus ductility of at least 20% elongation in two in.

Brazed seams must be 1½ times stronger than parent metal, and welds must pass bend and tension tests.

As soon as the longitudinal seam is brazed into the cylinder body, the cylinder rolls to an automatic welding station where heads are welded simultaneously to





ABOVE — Heads are welded simultaneously to cylinder body with automatic submerged-arc welding heads. BELOW — Sheet of high strength steel takes first step toward becoming cylinder.

the cylinder body with automatic submerged-arc welding equipment made by Hobart Bros. Co., Troy, Ohio. The cylinder with heads clamped in position is rotated at the rate of 25 ipm. After the cylinder is completed, it is then tested at 100 lb pressure.

After stress-relieving, it is filled with water and put under 480 lb of internal pressure for at least 30 seconds. Gages and recording charts make permanent records of the tests. After painting, there is another 100-lb test.

Testing doesn't end here. One of every 200 cylinders is placed in a jacket and 480 lb of pressure is again applied. The cylinder must expand and return to certain tolerances. This information is sent to the Bureau of Explosives where it is kept on record for the life of the cylinder.

Another cylinder, selected from each lot of 200, is cut up so welds can be tested. The base metal is also tested for ultimate tensile strength, elongation and area reduction.

If a cylinder fails any of these tests, two more are selected from the same lot. If either one of these fails any of the tests, the whole lot is rejected. These test results are also sent to the Bureau of Explosives.

WELD FLAWLESSLY and PERFECTLY because with TEC...

- **YOU SAVE on GAS!:** Engineered to expand gas volume and control turbulence for a uniform gas flow.
- **YOU SAVE in PARTS!:** No stock of spare parts necessary. Unit construction in all models.
- **YOU SAVE in TIME!:** See what you weld. Nozzles for every situation.
- **YOU SAVE in LABOR!:** Less weight . . . less fatigue . . . less down time.

TEC — MANUFACTURERS OF VISUWELD EQUIPMENT
TEC TORCH CO., INC.
CARLSTADT, N. J.

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more than 50 alloys to choose from permit pin-point selection for every overlay job

With more than fifty Coast Alloys to choose from you can select the one specific alloy best suited, within the narrowest of limitations, for any overlay application—an alloy that will assure longest possible life for the overlay.

The Coast Metals line is the result of a quarter century of specialization in the development of alloys to meet severe service conditions and to provide maximum efficiency in one or more of the following:

IMPACT RESISTANCE
ABRASION RESISTANCE
CORROSION RESISTANCE
HEAT RESISTANCE
HIGH TEMPERATURE BRAZING

Various Coast Alloys are supplied as drawn or tubular wire for automatic welding—coated electrodes for manual welding—gas welding rods—alloy powders for spray coating and high temperature brazing—complete castings for critical parts.

Write for information. Or, if you have a problem, ask for recommendations.

COAST METALS, INC.

203 Redneck Avenue • Little Ferry, N. J.
COAST METALS CANADA (LTD.), HAMILTON, ONT.

HARD FACING WELDING RODS
BRAZING POWDERS • ALLOY CASTINGS

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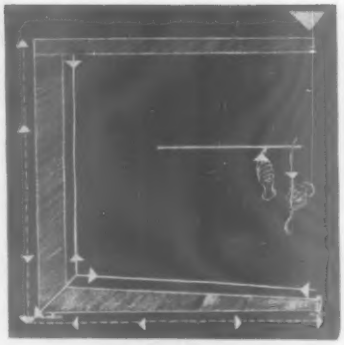


NEW "C" leg, developed as part of U. S. Steel's "Study in Steel" program is welded for maximum strength.

A few months ago the steel industry promised a market battle. Now . . .

Steel takes the offensive

IN ITS FIRST MAJOR effort to take the offensive in the market battle, U. S. Steel Corp. recently disclosed design concepts aimed at making steel the top design material for everything from toys to stadiums.

And welding will have an important role in the battle.

Following up a vow to meet new competition (WELDING ENGINEER, July 1960, *Steel, aware of its competition, pleads its own case . . . and plans an offensive*, p. 32), U. S. Steel recently displayed a variety of products including a complete office equipped with new type office furniture.

One item developed in this "Study in Steel" program is a new "C" leg. Strength is attained by welding steel members together while under tension. This move multiplies the unit's strength far beyond a simple bar bent into a "C" shape.

Attempting to achieve this strength with steel or any other metal simply by depending on bulk would require an unacceptable massive structure.

The design concepts in the new program are based on three major mechanical principles required for structural efficiency — tension, compression, and cantilever action. All three are dependent on the inherent strength of the structural material involved.

Bay E. Estes, Jr., U. S. Steel's commercial vice president of marketing, made it clear that the company is not in the design business and has no intention of going into the furniture business.

U. S. Steel is offering its design ideas to manufacturers and fabricators with no strings attached. Anyone interested can take all or any part of these design ideas.

According to Estes, "They were developed to show what can be done once the personality of steel is recognized and understood."

The design exhibit will be shown in selected sales districts across the country.

IN SUMMARY...

The first welded main condenser using aluminum brass condenser tubes, half of which were supplied by **Phelps Dodge Copper Products Corp.**, New York City has undergone initial tests at Consolidated Edison's Astoria, N. Y., No. 4 Unit . . . **Welded Steel Tube Institute,** Cleveland, has changed its name from the **Formed Steel Tube Institute.**

A study-by-mail safety course for industrial foremen, developed by the **National Safety Council,** Chicago, is designed to keep key men on the job while they acquire necessary safety know-how . . . **Cole Engineering, Inc.**, Oakland, Calif., has a new steel fabricating plant in Hayward, Calif., capable of handling weldments up to 60 tons enabling the firm to expand into heavier fabrication and field erection . . .

Trucks for transporting a weldor and equipment to industrial maintenance jobs are now in use in several plants. The trucks, pioneered by **Cushman Motors,** Lincoln, Nebr., a subsidiary of Outboard Marine Corp., are generally rigged for both electric and acetylene equipment, but Tig equipment can also be mounted . . .

Sales, engineering and manufacturing facilities of **Cryogenerator, Inc.**, moved recently to a new plant at Mendon and Angell Rds., Ashton, R. I. These activities were formerly carried on in Mount Vernon, N. Y. . . . **National Cylinder Gas Div.** of Chemetron Corp., Chicago, has installed liquid oxygen converters at **Mansfield Oxygen Co.**, 156 E. 4th St., Mansfield, Ohio, and **Interstate Welding Sales Corp.**, 1801 Marinette Ave., Marinette, Wis. . . .

Gary Steel Works, **U. S. Steel Corp.**'s largest mill is the safest big steel mill in the country, according to figures released by the National Safety Council . . . **Air Reduction Sales Co.**, New York City, has formed a new tonnage department for on-site sales of industrial gases, primarily oxygen, nitrogen, hydrogen, and argon . . . A Philadelphia ship and engine repair firm, **A. Moe & Co., Inc.**, has moved to new machine shop and metal fabrication facilities at 808 N. Front St. Joe Cannon is president of the firm . . .

The world's largest refiner and fabricator of platinum metals, **Engelhard Industries, Inc.**, has been listed on the New York Stock Exchange under the symbol ENG . . . Copies of the speakers' roster of the **Abrasive Grain Association** can be obtained by writing the association at 2130 Keith Bldg., Cleveland 15, Ohio . . . **The Atomic Energy Commission,** Washington, D. C., has revised downward its prices for cobalt 60 and established a new schedule of discounts for large quantity purchases . . .

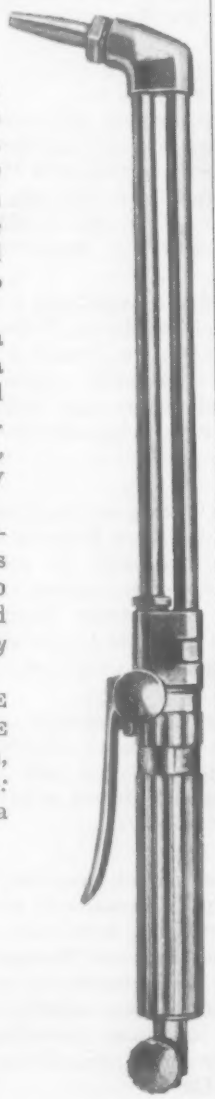
Ohio Carbon Co., Cleveland, has adopted a new uniform style of packaging for its line of replacement carbon brushes for electric motors, generators, and other rotating electrical equipment. Use of a bold pattern which employs a strong orange and blue color scheme is believed to have provided the necessary visual impact . . .

Latest techniques, machines and electrodes were demonstrated by the **A. O. Smith Corp.**, Milwaukee, at two recent welding shows in Lubbock and Odessa, Tex. The two-day shows were sponsored by two welding distributors, **Western Air Products, Inc.**, and **Western Oxygen, Inc.**, to bring their customers up to date in welding developments and help solve specific problems . . . The newest addition to plate treating capacity at the Homestead, Pa., works of the **U. S. Steel Corp.** is a continuous quenching and drawing furnace . . . A new plan making plastic wire spools returnable is now being offered by **Air Reducton Sales Co.**, New York City . . .

VALUE VERSATILITY

···you get more of both in the

PUROX TRADE MARK "E" Cutting Torch



When LINDE first offered the PUROX "E" Torch to industry, Ford's model T automobile sold for less than $500. Today's average car costs at least 350% more. *But the price of the "E" torch has gone up only 22%.* Since practically every part in it has been refined for improved performance and longer life, the PUROX "E"—granddaddy of cutting torches—is still one of the biggest oxy-acetylene apparatus values to be found anywhere.

Whatever your present requirements, there's a PUROX "E" Torch to take care of them. Choose a head angle of 75, 90, or 180 degrees in standard 20½-in. length, or a 36-in. model with 90-deg. head. Should new or special needs develop at any time, any model can be adapted to meet them by simply replacing the front-end assembly.

With four interchangeable front ends and 57 different nozzles, the PUROX "E" Torch easily handles any practical hand-cutting job. It cuts steel up to 12 in. thick, washes pads, cuts rivets, gouges, and pierces. *And it performs efficiently on acetylene or any other commercial fuel gas available.*

See the PUROX "E" Torch today at your LINDE Distributor's. Or write for free folder, F-1313. LINDE COMPANY, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde Trade Mark — UNION CARBIDE

The terms "Linde," "Purox," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

VIPs in review

At A. O. Smith Corp., Milwaukee, *T. L. Taylor* has been appointed to group merchandising manager. Taylor's initial duties will include responsibility for the programs of the firm's welding products and electric motor divisions.

Taylor

Townsend

Phillips

Hendrich

At Tweco Products, Inc., Wichita, five men have been appointed to new positions: *J. T. Phillips*, formerly production manager, has been named general sales manager; *L. J. Hendrich*, promoted from Harper, Kans., branch plant manager to general production manager; *J. L. Townsend*, company secretary, to advertising and sales promotion manager; *Jack R. Kester* to new product and tooling development engineer; and *William R. Roberts* to manager of the Harper branch plant.

Bryant

Pryor

At Contour Sales Corp., Compton, Calif., *Gladys Bryant* has been named executive secretary and *William R. Pryor* personal secretary to firm president John H. Holder.

John W. Gravdahl has been appointed vice president in charge of engineering of A. Moe & Co., Inc., Philadelphia. A graduate of the U.S. Merchant Marine Academy and Brooklyn Polytechnic Institute, Gravdahl was formerly with Gibbs & Cox, Inc. and the Hoboken Div. of Todd Shipyards Corp.

Gravdahl

Tuthill

Roger W. Tuthill, until this time assistant manager of the equipment engineering and development department, has been appointed manager of engineering for Air Reduction Sales Company's Special Products Department, New York. Tuthill, an electrical engineer who was employed by General Electric Co. for 16 years, will supervise the design and construction of all custom-made equipment involving uses for gases and the cutting and joining of metals.

Kadonoff

Langley

Stoody Co., Whittier Calif., has appointed *Max Kadonoff* as company field representative for the eastern part of Canada. Kadonoff, formerly a welding specialist for Canadian Fairbanks-Morse, will work with Air Reduction Canada Ltd. on hardfacing problems in Ontario, Quebec and the Maritime provinces.

C. J. Langley has been named assistant district manager for Air Reduction Sales Co. in Philadelphia. Langley will assist in the sale and distribution of products marketed through the Philadelphia district. Langley joined Airco in 1946 as a member of the general technical sales department in New York City.

McVickar

Bancroft

National Electric Div., H. K. Porter Co., has appointed *Edward S. J. McVickar* manager of mining and welding cable sales. For the past 10 years, McVickar has been associated with General Cable Corp.

The Cincinnati Milling Machine Co. has promoted *William G. Bancroft* to manager of the grinding wheel plant for the products division. Bancroft succeeds *Maurice Gormly* who was promoted to manager of the products division.

Simon A. Greenberg, formerly technical secretary of the American Welding Society, has opened an office in Flushing, N. Y., as a consultant in metals joining, manufacturing operations, quality control and other industrial operations.

Ralph Staal has been named industrial sales manager of Marquette Manufacturing Co., Minneapolis. Staal had been sales manager since joining the company in 1957.

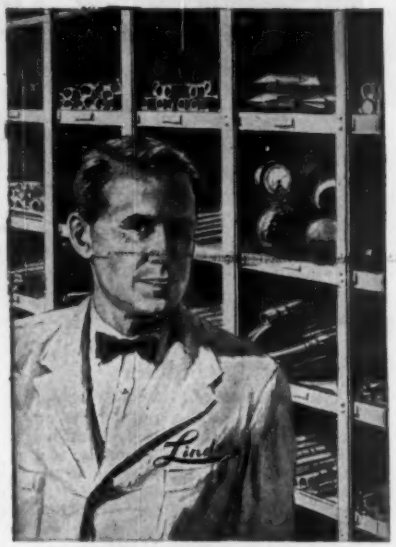
Jack H. Rees has been named to head the new A. O. Smith Corp., Milwaukee, Welding Products Division office in Washington, D.C. Rees, a sales representative, will serve customers in Maryland, Virginia and North Carolina.

Rees

Holder

Eutectic Welding Alloys Corp., Flushing, N.Y., has named *Melvin S. Holder* as regional manager supervising regions in Indiana and Southern Illinois. Holder, previously a field supervisor in the area, joined Eutectic in 1954 as a technical representative.

Your "LINDE" Distributor WANTS TO HELP YOU... TO DO A BETTER JOB!



Your success is his success. As your business improves, his business with you increases. As your confidence in him grows, it benefits you both.

Your local LINDE Distributor offers a complete line of industrial gases, equipment, and supplies. He can satisfy almost any welding or cutting need *from stock*.

Difficult welding or cutting problems? See your LINDE Distributor. His technical background and experience, backed by Linde Company resources, can help get you on the right track quickly.

Talk with your LINDE Distributor today. As an independent local businessman, he is vitally concerned with your success. If you can't find his name in your telephone directory, write for it. Dept. 310, LINDE COMPANY, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde

UNION CARBIDE

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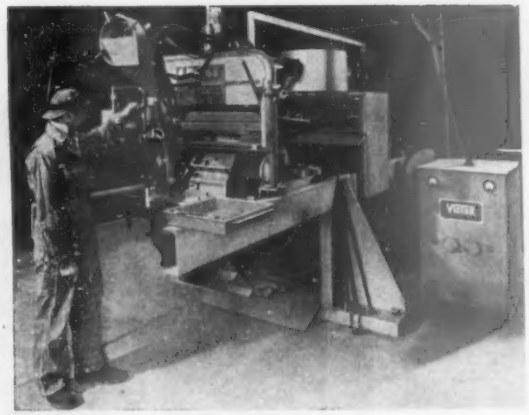
Circle No. 195 on Reader Service Card

New products

. . . use card on page 103



Automatic rebuilder

Automatic rebuilder (Victor grouser bar welder) is self loading, handles all lengths and widths of track without disassembly. Oxyacetylene trimming tool automatically trims grouser bar to be reconditioned. Air-hydraulic holding fixture places new bar in curved position holding it for welding so tacking not needed, and no bowing of grouser pad after welding. Unit uses automatic continuous-coil wire for welding. *Victor Equipment Co.*

Circle No. 1

E6011 electrode

E6011 electrode (Hobart 335A) with small amount of iron powder added to coating to improve arc stability, decrease spatter and increase deposition, can be used on a-c or d-c, straight or reverse polarity. Available in 3/32 in. diameter in 12 in. lengths; 1/8, 5/32, 3/16, 7/32 in. in 14 in. lengths and 1/4 in. in 18 in. lengths. *Hobart Bros. Co.*

Circle No. 2

Flexible Tig torch

Controlled angle torch for use in Tig welding features flexible body readily hand-adjusted to any angle as well as extended to reach into difficult recesses. Water-cooled model is rated at 180 amp a-c/d-c, continuous duty; 300 amp intermittent duty. Lower and higher rated water-cooled torches and an air-cooled torch will be available later. Advantages claimed are low inventory, since one torch does the work of many, and less weldor fatigue, since weldor sets the torch angle to fit his hand and style. *Falstrom Co.*

Circle No. 3

Cryogenic pump

High-pressure, high-flow cryogenic pump delivers up to 20 gpm at pressures up to 15,000 psi, according to manufacturer. Unit is 5 cylinder, fixed displacement pump with pistons driven by one-piece push rods in contact with rotating, axial swash plate. Lubricated drive end operates at ambient temperatures eliminating lubricant freeze. Cryogenic section operates free of lubrication. Intermediate section provides thermal barrier to cryogenic and ambient ends of pump. Unit can operate on inlet pressure as low as 10 psi. *The Cosmodyne Corp.*

Circle No. 4

Welding regulator

Voltage-compensating regulator for resistance welding control keeps heat within ± 2% of present value despite line voltage with changes ranging from −20% to +10%, states manufacturer. Unit is plug-in with or without enclosure for connection to phase shift heat control of welder. Unit regulates firing of ignitron contactors to maintain constant root-mean-square heating value for each half-cycle pulse to welding transformer primary. Speed of correction is 2 or 3 cycles. *General Electric.*

Circle No. 5

Testing machine

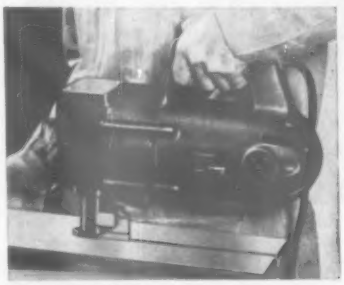
Tensile testing machines with capacities up to 40,000 lb has stroke of 4 in. Specimens to 10 in. long by 2 in. wide can be handled. Standard jaw capacities are 0 to ⅜ in. or ⅝ to ⅞ in. for flat specimens: ⅛ to ¼ in., ¼ to ½ in. or ½ to ¾ in. for round specimens. Compression testing area accommodates specimens to 4¾ in. high and 7 in. wide. *Steel City Testing Machines, Inc.*

Circle No. 6

Magnetic-particle units

Ferroflux and Portaflux portable magnetic-particle units detect surface and near-surface flaws on a wide variety of metal products. Ferroflux weighs less than 30 lb, magnetizes in any direction through positioning and works on painted and non-painted surfaces. Unit, with optional voltage regulator, operates on any 110-volt a-c line and has built-in silicon rectifiers for d-c supply. Portable 600-amp a-c generator and control are carried in slender aluminum case. Unit requires only 10 amp from any 10-volt a-c line. It has three-position intensity control and two, 7-ft flexible, oil-resistant magnetizing cables. Unit measures 17 by 12 by 8 in., weighs 60 lb. *Picker X-Ray Corp.*

Circle No. 7



Hand nibbler

Portable hand nibbler cuts through ¾ in. steel plate. Cutting capacity includes hot or cold rolled steel and up to 5/16 in. aluminum. Model EHN features cutting speed of 35 ipm through ¾ in. steel. Minimum cutting radius is 8 in. Powered by 2½ hp universal type motor, a-c or d-c, unit operates on 115 volts, 60 cycle. Unit weighs 20 lb, is 13¾ in. overall. *Fenway Machine Co.*

Circle No. 8

Base films

Three high-contrast films offer greater durability and dimensional stability to reproductions of drawings, according to manufacturer. Films are available in rolls for drawing up to 52 in. wide and in sheets in wide range of standard drawing sizes. *Eastman Kodak Co.*

Circle No. 9

if you need

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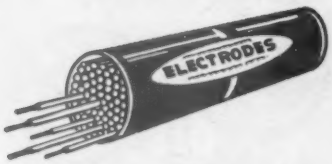

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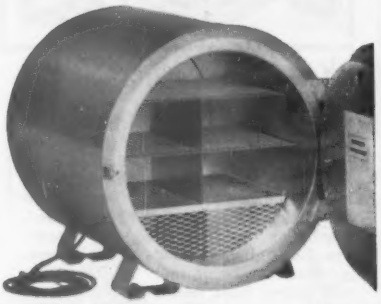


DryRod®

ELECTRODE

OVEN

You need both for trouble-free Profitable Welding

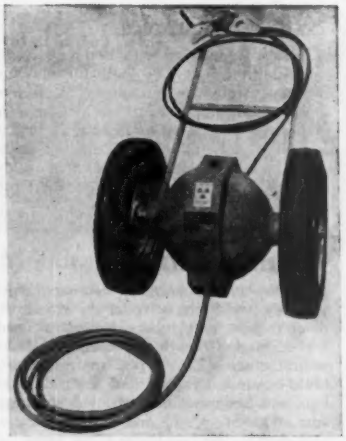
The instant you unpack mineral coated electrodes, they start soaking up moisture. In *only 2 hours* they often soak up as much as 13 times allowable US Specifications. Moist rods cause porosity, under-bead cracking, rough welds, etc. Your rejects and rod scrap cut heavily into profits.

For consistently *good* welding, you *have* to keep rods *dry*. This oven does it . . . at pennies of cost.

Write for descriptive literature.

PHOENIX PRODUCTS COMPANY
4727 NORTH 27th STREET, MILWAUKEE 9, WIS.

Circle No. 196 on Reader Service Card



Radiography cameras

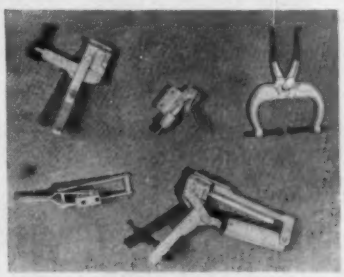
Cobalt 60 radiography cameras are designed primarily for panoramic and internal radiography. Family of five model 60 machines have capacities of 1, 5, 10, 30 and 100 curies of cobalt 60 respectively with weights ranging from 190 to 1,100 lb. Operator has choice between stronger or weaker cobalt 60 source or between cobalt 60 source and iridium 192 source. Cobalt 60 is useful in radiographing from ¾ in. to over 12 in. of steel. Iridium 192 has range of ¼ in. to 3 in. of steel. Model 60-1 through 60-100 cameras are mounted on pneumatic-tired wheels and provided with handles. *Radionics Inc.*

Circle No. 10

Tig Welder

Balanced wave, transformer type power source for use with Tig equipment features capacitor balancing, high open circuit voltage (165 volts), five broad overlapping ranges for applications requiring 20 to 400 amp, good wave form in all ranges, electrical control of amp output for remote control with standard accessories, and power factor correction. Machine rated at 300 amp, 100% cycle. Available for manual applications with gas and water controls and high frequency unit built in; and for semiautomatic and automatic operations with gas and water controls, but no high frequency unit. *Air Reduction Sales Co.*

Circle No. 11



Toggle-action clamps

Toggle-action clamps, designated Uni-Klamp, is engineered to give positive action with minimum of force for locking or unlocking, states manufacturer. *Universal Engineering Co.*

Circle No. 12

SINGLE

inch of shunt travel controls full range of current

M&T Murex AC Industrial Arc Welder

One inch of shunt travel adjusts for entire output current range • Shunt is rigidly, permanently mounted, chatter-free • Patented dual-coil transformer affords balanced electrical circuit • Promotes smooth, steady arc under all welding conditions • Glass insulated windings add to transformer life • Write for data sheet that tells you more.

M&T MUREX welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

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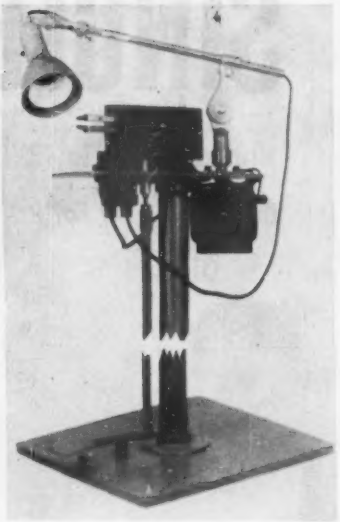


Brazing unit

Electric carbon-block brazing unit for joining solid and stranded copper wires, known as Model M-101, is pedestal type intended for use by standing operator. Unit weighs 50 lb. Unit uses 115 volt, 60 cycle current with capacity for brazing wires from No. 30 to No. 16 cycle AWG stranded or solid. Brazer makes use of small silver solder pellets which are obtainable in various diameters and lengths. No flux is required in making brazed joints. *M. G. Steele Co.*

Circle No. 13

Safety spectacles

Safety spectacles with two-tone frame provide protection and looks for men and women, states manufacturer. Cellulose acetate butyrate spectacles available in eye sizes 44mm, 46mm, 48mm; bridge sizes 18mm, 20mm, 22mm, 24mm; spatula temples in all sizes. Frames in charcoal gray on crystal. *Glendale Optical Co.*

Circle No. 14

Heating units

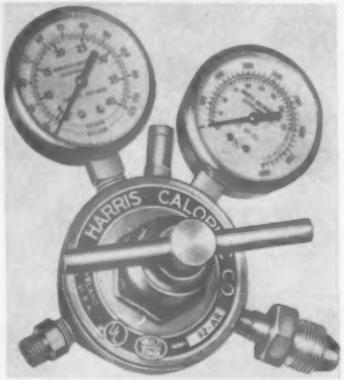
Clamp-on resistance heating units simplify weld stress relief in small diameter pipe and tube; eliminates need for induction heating windings, states manufacturer. Two types are produced; both clamp over pipe and around weld and can be used in restricted working space. Model NV-C unit is low-voltage, high-current heater for use on pipes or tubes from 2 to 6 in., OD, and with wall thicknesses of 3/8 in. and smaller. Model Class 712 is designed for higher voltages in pipe from 1 to 2¾ in., OD, inclusive. *Electric Arc, Inc.*

Circle No. 15

Hardfacing electrode

Stoody 1105 manual electrode reclaims large sprockets, churn drills, drive tumblers, tractor grousers and most wearing parts subject to severe impact and abrasion. Rod is made by extruding iron powder coating containing chromium, manganese, molybdenum and vanadium on mild steel core wire. Electrode can be applied to carbon and low alloy steels but is not suitable for welding on managanese steel or cast iron. Rockwell C hardness ranges from 36 to 42. Produced in 5/32 in. and 3/16 in. diameters, 14 in. length, and in 1/4 in. diameter, 18 in length. *Stoody Co.*

Circle No. 16



Metering regulator

Metering regulators for oxygen, carbon dioxide, helium, nitrogen, argon, hydrogen, propane and acetylene can be mounted in any position without affecting accuracy of flow. No gaskets to loosen; gauge dial is designed to show actual flow in cu ft per hour consumed. Regulators are virtually maintenance free and offer greater profit because accuracy and uniformity of flow permits lower flow settings, according to manufacturer. *The Harris Calorific Co.*

Circle No. 17

WRAPS UP THE TOUGHEST SHIELDING JOBS EASILY, INEXPENSIVELY

SPA-FLA

WRAP-AROUND

SAFETY SHIELD

Here's the ideal safety shield for close-quarter, all-around protection. SPA-FLA's flexible welded wire insert makes it self-standing, lightweight, highly flexible for "wrap-around" shielding when welding, cutting, grinding, etc. Rolls up compactly for carrying or storing, gives years of low-cost service. Steel "D" rings at corners for hanging. In rugged UL approved 15 Oz. Duck, or in Weld-Tex vinyl coated glass cloth. There are seven stock sizes from 18" x 36" to 72" x 108". Write for free catalog!

FROMMELT

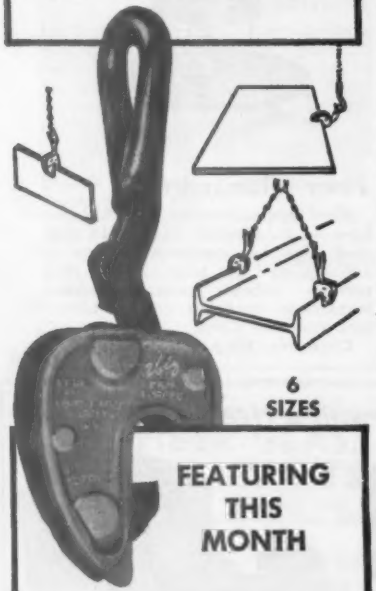
FROMMELT INDUSTRIES, INC.
Dubuque, Iowa

THE NAME TO REMEMBER IN APPROVED SAFETY PRODUCTS

PORTO SCREENS · HANDI-HUTS · WELDING CURTAINS · PROTECTIVE GARMENTS · PROTECTIVE FABRICS

YOUR BEST MOVE . . . MOVE with **MERRILL** MATERIAL HANDLING DEVICES FOR THE MOST IN *Safety and Economy*

Imitated, but never duplicated, Merrill Lifting Clamps are Drop Forged to give you Safety in Handling and Economy in Operation.



6 SIZES

FEATURING THIS MONTH

AUTOMATIC SAFETY LOCK FORK LIFT ATTACHMENT

Transforms any fork lift truck into a safe, efficient mobile overhead lifting unit.

Over 25 Material Handling Devices described in our catalog C-2.

Ask for a copy.

MERRILL BROTHERS

Producers of Drop & Press Forgings

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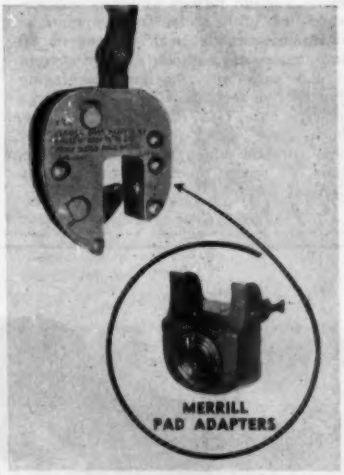
1-60

Circle No. 199 on Reader Service Card

Mobile welder

Self-contained, self-propelled welding unit with engine coupled to generator has towing capacity rated at 2,000 lb draw-bar pull. The 400 amp model powered by Chrysler 6 cylinder industrial engine; 600 amp model powered by Chrysler V8 cylinder industrial engine. Weldmobile can supply up to one kilowatt (110 volts d-c) auxiliary power for operating lights and electric motor powered equipment. Two wells and brackets located at rear are for acetylene and oxygen tanks. Controls are located in front of driver's seat on dashboard. *Hobart Bros. Co.*

Circle No. 18



Lifting-clamp pad

Adapter unit for special opening G clamp increases range of grips and eliminates need for another clamp where large grip variance would usually require it. A 1-ton with ¾ in. to ⅞ in. grip can be converted into clamp having grip O to ⅞ in. by slipping adapter into position which provides one clamp to handle O to 1⅜ in. materials. A 3-ton 1⅜ in. to 3¾ in. can be converted to ¾ in. to 3¾ in. Unit complete with pad is replaceable. *Merrill Bros.*

Circle No. 19

Two-finger glove

Polyethylene two-finger glove combines advantages of mitt with coolness and dexterity of glove. Reversible glove can be disposed of after few uses or re-used. Polly Line glove provides low-cost protection against acids, caustics and injurious chemicals, according to manufacturer. Glove is lintless, watertight, moisture-proof and non-toxic. Also available in 5-finger type. *Singer Glove Mfg. Co.*

Circle No. 20

DOUBLE

benefit of controlled arc: better welds, faster welding

M&T Murex CAPS* Controlled Arc Power Supply

Rectifier-type, constant voltage welder for semi or full automatic welding • Improves weld quality • When teamed with constant rate wire feed, arc length, deposition rate remain constant despite fit-up variations • Bead shape is more uniform; stubbing and burnbacks are greatly reduced • Economical to install and operate • Write for data sheet.

*Trademark

M-T MUREX welding products

METAL & THERMIT CORPORATION

General Offices: Rahway, New Jersey

Circle No. 197 on Reader Service Card

Inert-gas welders

Two inert-gas welding machines, one a-c/d-c, one a-c only, can be used for manual, automatic, Mig and Tig welding by changing switch or by plug-in controls. Flux density control permits remote control of both a-c and d-c welding currents. Remote control by operator permits heat adjustments from 3 to 410 amp. Both models of the Muretran have built-in high-frequency stabilizer, primary line contactor, separate control transformer, thermal overload protection and 20-ft remote control cable and switch assembly. Plug-in timers available in timing ranges from 0 to 3 or 0 to 30 seconds. Both models operate from single-phase 230/460 a-c power and require 21 kva. *Metal & Thermit Corp.*

Circle No. 21

Power sources

Two new welding power sources for use with manual and automatic Mig welding equipment can provide constant arc voltage output. Machines are rated at 300 amp, 100% duty cycle and 500 amp, 100% duty cycle. The 300 amp d-c rectifier Aircomatic CV welder is of vertical design providing continuous infinite down slope adjustment through hand wheel. The 500 amp d-c unit (horizontal) can be used for welding with all diameter wires where conventional constant arc voltage or down slope is required. Machine can also be used with submerged-arc welding process. *Air Reduction Sales Co.*

Circle No. 22

Ignitor tubes

A pair of high-voltage gas-mercury thyratrons designed for ignitor firing in pulse power welders have maximum peak anode voltage ratings (inverse and forward) of 3,500 volts. Tubes operate at maximum cathode peak current of 30 amp; maximum cathode average current of 2.5 amp with maximum averaging time of five seconds. GL-7726 has large lug-type base; GL-7725 has plug-in base. Both have quick-heating filamentary type cathode which takes only 20 seconds to reach operating temperature. *General Electric.*

Circle No. 23

Guide reports

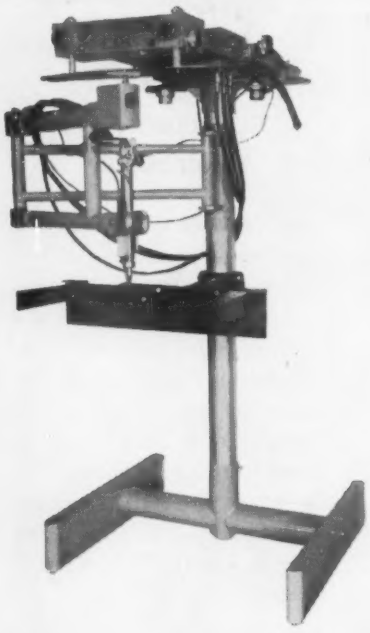
Monthly laboratory guide reports are designed to bring quick and authoritative answers to many typical problems encountered in laboratory procedures. Reports will cut across all fields of industrial laboratory work and will cover not only conventional approaches, but the latest in lab techniques as well. *New York Testing Laboratories, Inc.*

Circle No. 24

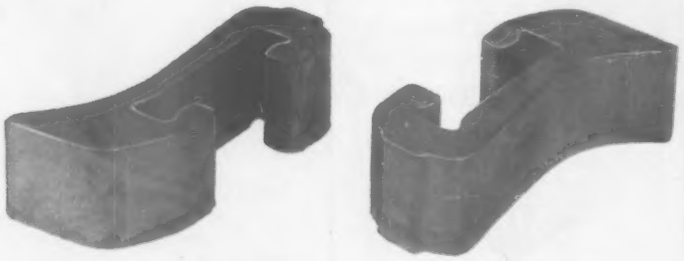
Floor salamander

Floor type salamander, No. 1412, features 14 in. diameter base of 13 gage steel. Unit has maximum capacity of 150,000 BTU per hour (at 100 psi); operates without pressure regulator, burns clean, smokeless, odorless LP-Gas fuel. *Insto-Gas Corp.*

Circle No. 25



with a Heath Ultra-Graph



Rough cutting of blanks saves hours of machining

Production time for a single part can be reduced 25-50% by initially flame cutting the desired shape with an Ultra-Graph Guidance Machine. Dimensions are held to close tolerances and exceptionally clean smooth finishes are obtained. Only a few minutes are required to cut any part suitable for weldment, assembly, or additional high finish machining. A U-G machine affords distinct economic advantages for prototype and short run or quantity production.

SERIES 460 ULTRA-GRAPH

Send for information on Ultra-Graph Guidance Machines for application to flame cutting or welding. See your Local Welding Supply Dealer for a demonstration.

HEATH ENGINEERING CO.

168 AULT ROAD
FORT COLLINS, COLORADO

Circle No. 201 on Reader Service Card

MOVE more metal with genuine Arcair* COPPERCLAD* ELECTRODES

No matter how you use Arcair you'll get best results *only* with genuine Arcair *COPPERCLAD* electrodes — because Arcair electrodes are the finest the world's largest carbon research laboratory has been able to develop.

Arcair electrode quality is consistent, which means you get less breakage, highest resistance to thermal shock, maximum arc stability.

Insist on genuine Arcair *COPPERCLAD* electrodes. Available from your welding supply distributor in all standard sizes. Special sizes by request.

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THE Arcair COMPANY

427 S. Mt. Pleasant St., Lancaster, Ohio

Flood FIBER GLASS HELMETS

Seamless and stoutly reinforced with more comfortable and durable Fit-Rite. Snap-on ratchet type headgear.

No. 51-SF-2H

NEW DESIGN ADVANTAGES

1. Lighter weight.
2. Smoother, easier to clean.
3. Moisture-proof, non-warping.
4. Superior resistance to heat.
5. Easily sterilized.

These and other advantages give you better protection, comfort and ECONOMY.

INSTANT Head Size Adjustment

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Enjoy real savings with Flood's

1000-HOUR COVER LENSES

Flood manufactures a complete line of welding and safety equipment . . . if you have a problem feel free to call upon us.

AT YOUR DISTRIBUTOR OR WRITE:

FLOOD SAFETY PRODUCTS CO.
3035 West Lake Street, Chicago 12, Illinois

Circle No. 202 on Reader Service Card

Worker's goggle

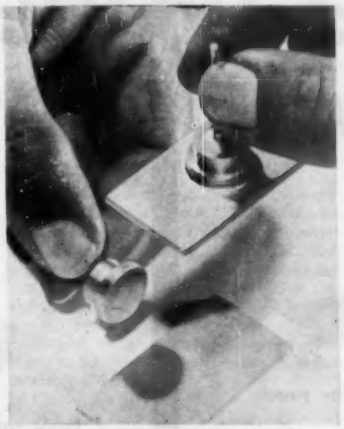
Molded acid resistant rubber goggle in forest green color with soft-rolled edges features large lens size, providing wide-angle vision. It will fit over any modern eyeglass frame. Available in aluminum with non-corrosive vents or without. *Bausch & Lomb Inc.*

Circle No. 26

Hardfacing powders

Spray Fuse powders cut hardfacing time up to half and minimize finishing costs through control of deposit within 1/32 in., states manufacturer. Cobalt base alloys are applied by conventional powder spraying guns followed by fusion with oxyacetylene torch. Process offers advantages where Stellite deposits up to 1/16 in. thick are required. *Deloro Stellite.*

Circle No. 27



Silicon rectifier

Series of silicon rectifiers, designed for solder mounting and possessing unique physical and electrical characteristics, are glass-metal hermetically-sealed, welded, and nickel plated. Peak inverse voltage of 50 to 400 are available in each of four series rated 10, 15, 25 and 35 amp d-c average current, at 150 C average case temperature. All series available in standard or reverse polarity at no price premium. Overall case height of rectifiers is 7/16 in., base diameter is ⅝ in. *Syntron Co.*

Circle No. 28

TRIPLE benefits provided by this convenient, economical welder

M&T Murex AC-DC Combination Welder

Has unique patented dual-coil transformer for smooth, steady operation, instant starting and recovery voltage • Single crank controls chatter-free shunt that slides only one inch for full, stepless range of output • DC delivered by non-aging, hermetically sealed silicon diodes • All in all: (1) long life, (2) low operating costs, (3) superior arc characteristics • Write for data sheet.

M-T MUREX welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

Circle No. 197 on Reader Service Card

Quick-bond clamp

Quick-bond clamp consists of high conductivity bronze body with chain and speed-screw for attaching to pipeline. Designed for pipe, clamp takes all sizes from 2 in. up and can be applied in less than 15 seconds to give positive low resistance contact, says manufacturer. Clamp provides way to connect any cable to pipe for arc welding or for any temporary electrical connection to pipelines. Clamp avoids arc-burns or other stress concentrations to costly, high pressure code piping. Clamp will handle 300 amp, has no loose parts and may be attached permanently to cable for ready use. *Pipetrom Co.*

Circle No. 29

Strip seam welder

New utility strip seam welder welds clean or galvanized metal up to 48-in. wide and from 16 to 20 gage thick at a speed of 30 fpm on clean stock. Welding power is provided by a 150 kva transformer. Weld strength of 100% of annealed parent metal is achieved by an end-lap weld, making unit particularly valuable on existing lines where greater joint strength is required, according to manufacturer. Unit can be used in operations such as roll forming, reprocessing, galvanizing, slitting, shearing, recoil, buildup, inspection, and on tube mill. *National Electric Welding Machines Co.*

Circle No. 30

Shut-off valve

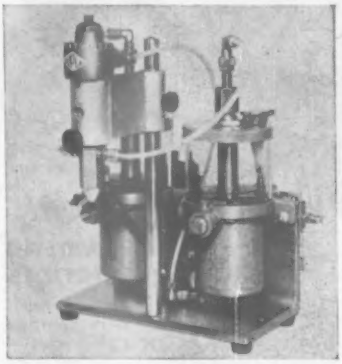
Combination shut-off and check valve for use with oxygen and fuel gas at line distribution system station outlets assures flow in one direction stopping flashback or back fire. Back check feature eliminates need for separate check valve. Designed for working pressures to 400 psi, RegO model 7160 and 7161 line station valves have forged brass bodies, brass trim, resilient seat and diaphragm. Other outlet forms available within limits of forging. *The Bastian-Blessing Co.*

Circle No. 31

Foil tester

Ductility testing machine for foil and thin sheet work (Model TSD), is designed to permit quick, accurate readings for both experimental and production work, states manufacturer. Gripping pressure and movement of test piston of machine may be adjusted to different levels independently to fit test conditions desired. Available in five gauge calibrations from 200 lb to 2,000 lb for work ranging from .002 in. to .020 in. maximum thickness. *Detroit Testing Machine Co.*

Circle No. 32



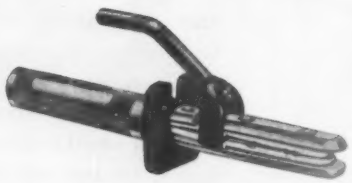
Automatic dispenser

Model 100 Nuplabond machine is small, self-contained, high-speed unit for metering, mixing, and dispensing two-component plastic systems, such as epoxies. Unit is easily adjusted to a wide range of cycles and materials, simple to operate, easy to clean, and is designed to be used manually, or adapted to any automatic or semiautomatic production line as a stationary piece of of equipment, states *New Plastic Corp.*

Circle No. 33

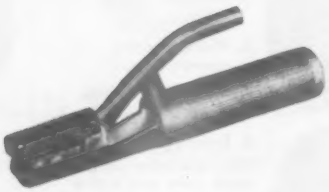
DURO ELECTRODE HOLDERS

THE DURO "STANDARD"



* Featuring "Long Jaw Design" for reaching hard to get at places.
* Cool operation-cool handling.
* Insulated handle and guard protects the operator.
* All parts easily replaced.

THE "ADJUSTABLE TENSION"



* Easy adjusting of Spring Tension for your requirements.
* New type cable connection prevents fraying of cable.
* Aluminum model weighs only 13 oz.
* All parts replaceable including copper alloy jaw.

For further information write:

THE DURO ENGINEERING COMPANY

71 Oregon Avenue, Hamden 17, Connecticut

Circle No. 205 on Reader Service Card

Use the best ! !

PACIFIC UW

FOR UNDERWATER WELDING

For mild steel underwater cutting Pacific UW has no equal. Using the same technique as applied on the surface, a skilled welder can produce 15 to 20 feet of fillet welds per hour. Welds will develop 80% of the original tensile strength.

PACIFIC UC

FOR UNDERWATER CUTTING

Steel, cast iron, bronze, monel and other non-ferrous metals of ANY dimension can be easily and quickly cut by any average operator. Pacific UC demands less skill, saves in operating costs.

For information on the complete line of Pacific electrodes write to:

PACIFIC *Welding Alloys*

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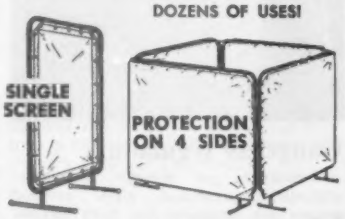
THOUSANDS NOW IN USE

ALL SIZES

3-SIDED MODEL

SINGER SCREENS have met with the approval of many industries. Incredibly light in weight. Rust-proof steel. No threads —assembles in minutes. Curtains of duck, neoprene-coated fiber glass or Johns-Manville aluminized asbestos cloth.

DOZENS OF USES!



NEW BIG CATALOG

Describes screens in detail. Complete line of work gloves, welding gloves and safety clothing.

Ask your dealer or write: *Special Products Division*

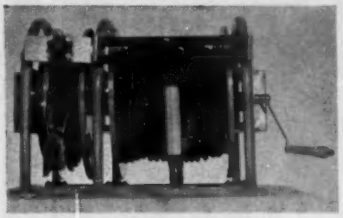
SINGER GLOVE MFG. CO.

860 W. WEED St., CHICAGO 22, ILL.

Circle No. 206 on Reader Service Card

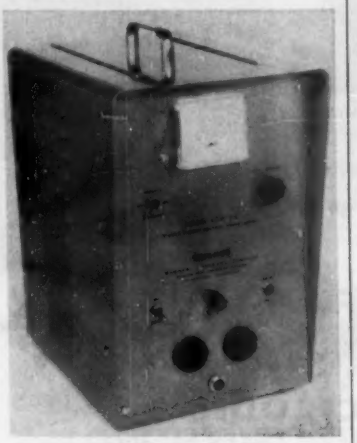
Cable reel

Two independent operating units of different cable capacities give a wide range utility to Model EA-11 "Weld-Reel" cable reel, according to manufacturer. Recommended for pipelines,



fabricating shops, road and bridge construction, power plant maintenance, and steel erection, model has one reel with capacity for 50 ft of 2/0 cable on a spring operated drum, and one reel with capacity for 200 ft on hand-operated drum. Unit makes it possible to put the required amount of either cable into use without delay of untangling problem, and to return it to safe storage in minimum of time after use. *United Specialties, Inc.*

Circle No. 34



Power supply

Forty watt-second stored energy welding power supply, the VTW-29, delivers a step-free adjustable range of power of 0.01 to 40-watt-seconds in 0.001 seconds. Pulse width of 1 millisecond assures no burning or discoloration of material, states manufacturer. Weld speeds are up to 120 spots per minute. Unit is packaged in a cabinet occupying less than 1 sq ft of bench space. *Hughes Aircraft Co.*

Circle No. 35

Comfort heaters

Electric infrared heaters transfer radiant energy directly from source to object without heating of intervening air. Ideal for areas where large air movements make conventional space heating costly or ineffective, where only occasional heating required, or for localized heating, according to manufacturer. Heaters are available in models for use with linear quartz tubes or standard high temperature T-3 linear quartz lamps converting as much as 86% of electrical energy into radiant output. *Fostoria Corp.*

Circle No. 36

QUAD-RUPLE

welding versatility: manual, automatic, inert-gas, spot

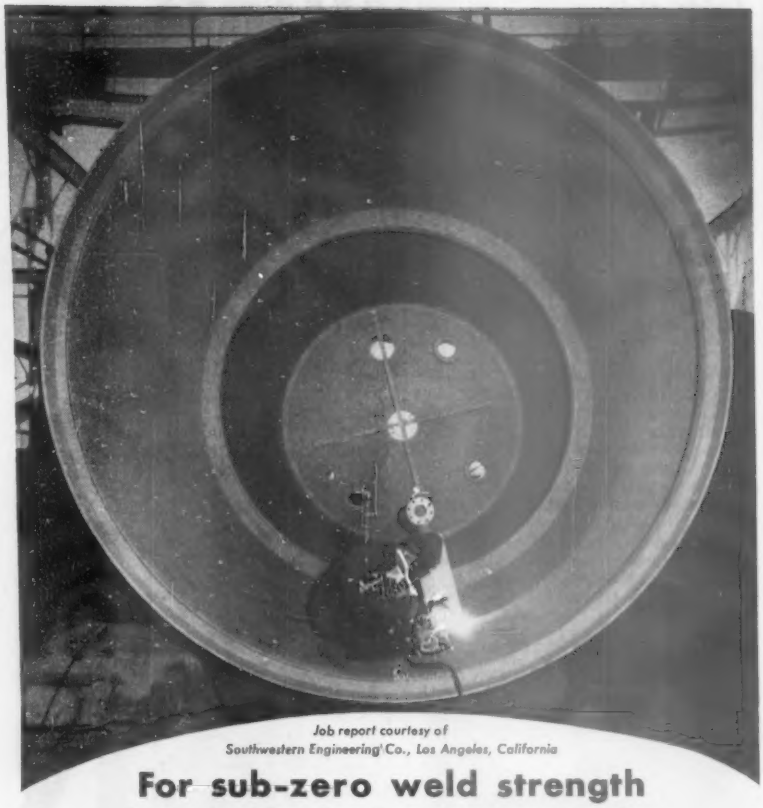
M&T Murex Muretran* All-Purpose Welder

Most versatile welder ever developed • Quick changeover to manual, automatic, inert-gas (MIG, TIG), and spot welding • Unique plug-in timers for gas pre-flow, post-flow, high frequency drop-out, spot arc • Patented, dual coil windings in saturable shunt transformer • Sealed silicon rectifiers assure highest efficiency, long life • AC-DC or AC models • Write for data sheet. *Trademark

M-T MUREX welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey

Circle No. 197 on Reader Service Card



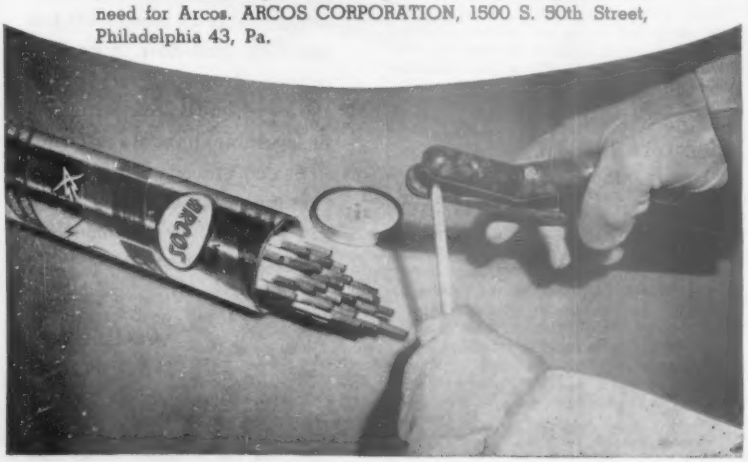
Job report courtesy of
Southwestern Engineering Co., Los Angeles, California

For sub-zero weld strength in missile fuel storage tanks

WELD WITH ARCOS

STAINLESS ELECTRODES

When completed, this tank will hold a liquid propellent fuel under 125 lbs. psi. Service temperatures will range from plus 200°F down to *minus* 300°F. The customer selected type 321 stainless for the vessel. To assure required impact strengths at extreme temperatures, Arcos STAINLEND 19/9Cb electrodes were recommended. This top quality weld metal joins the heads, shell seams, fittings and all attachments. Again—the tougher the test, the greater the need for Arcos. ARCOS CORPORATION, 1500 S. 50th Street, Philadelphia 43, Pa.



A-c welder

A-c welder, designated TC by manufacturer, is single phase, transformer type, built to operate from 230/460 volts primary and is NEMA rated as a 500-amp machine. Welder, with variety of factory installed optional equipment, has open circuit voltage adequate for starting with any a-c stabilized electrode. *Westinghouse Electric Corp.*

Circle No. 37

Solder pastes

Eutec-TinWeld paint-on solder pastes combine exact balance of alloy and flux and give long shelf life without metallic elements settling, flux separating, or hardening in jar, according to manufacturer. Paste is made in: all-purpose; lead-free, non-blackening for stainless and nickel alloys; neutral with non-corrosive flux for electronic work; special formulation for copper, brass and bronze. *Eutectic Welding Alloys Corp.*

Circle No. 38

Gaugeless regulators

Two-stage gas pressure regulators without conventional glass covered gauges are available for both oxygen and acetylene cylinders. Delivery pressure set with micrometer type indicator. Regulators are equipped with cylinder pressure indicator clearly visible at top, protected from damage by forged brass housing. Regulators available are oxygen regulator with maximum work pressure of 100 psi and two acetylene regulators with maximum work pressure of 15 psi. *Air Reduction Sales Co.*

Circle No. 39

Welding gun

Air-cooled push type welding gun and wire feeder for use with Mig process has a 60 deg goose-neck nozzle assembly and lever-type trigger. Gun can be used with submerged arc welding and Spray-arc welding using carbon dioxide as shielding gas or standard welding using argon as shield. Wire feeder includes remote speed control with 15 ft of service cord to provide wire speed adjustment to 600 ipm near work. Feeder operates on 115 volts, 60 cycle a-c. *Air Reduction Sales Co.*

Circle No. 40

Ignitron

Jumbo C size ignitron permits 50% boost in power output of standard size C welders without increasing equipment dimensions, according to manufacturer. Electrical capabilities of tube, type GL-7681, are midway between size C and size D welding ignitrons. In a-c control service, two new tubes, in inverse parallel, control 1,800 kva with corresponding anode current of 113.5 amp. With maximum anode current of 210 amp, corresponding maximum demand is 600 kva. Tube is rated at 600 volts rms for these capabilities. *General Electric.*

Circle No. 41

Brazing form

Wesgo Polyform, a physical form for brazing alloys, provides greater brazing convenience and economy in wide range application, manufacturer reports. L-shapped Polyform strip, slotted along widest dimension, can be bent around contour. Principal economic advantage is elimination of scrap. Strip available in thicknesses down to .002 in. Width of serrated or punched out section can vary from ⅛ to ⅝ in. in 1/64 in. increments. *Western Gold and Platinum Co.*

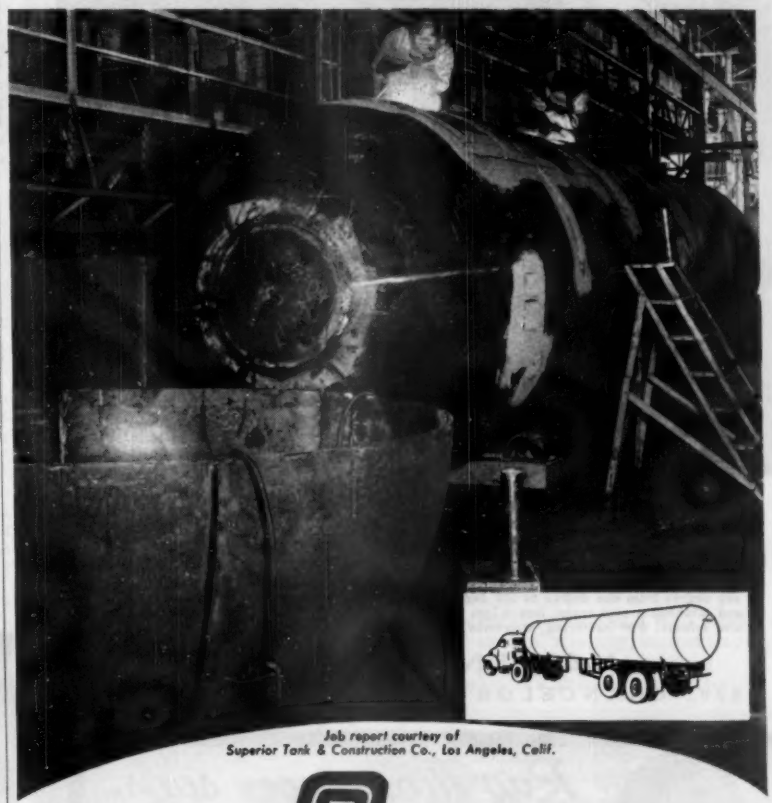
Circle No. 42

Safety goggles

Safety goggles have soft, flexible frame cushion which fits to face, all plastic vents — open louvered front and rear for dust conditions, and open louvered rear only for splash conditions — eliminating corrosion and electrical contract problems. Available in clear or green frame with clear or green single lens. *Welsh Mfg. Co.*

Circle No. 43

How X-Ray Quality Welds Make Low Alloy Steels Pay Off



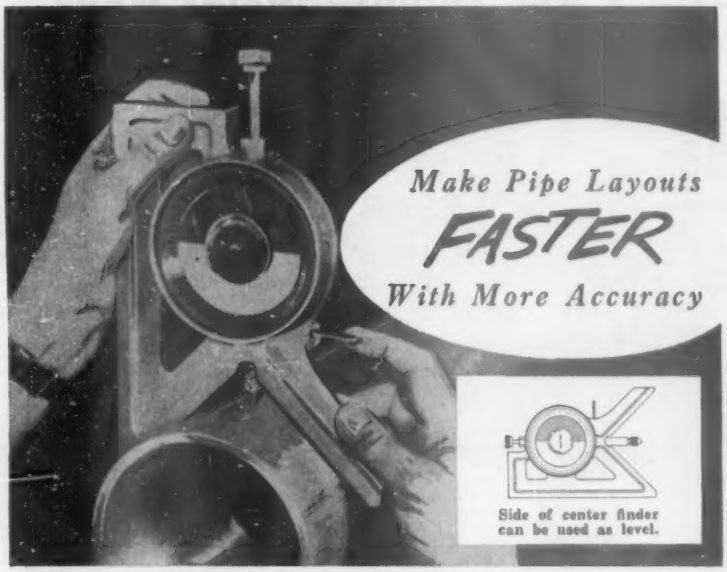
Job report courtesy of
Superior Tank & Construction Co., Los Angeles, Calif.

WELD WITH ARCOS

LOW HYDROGEN ELECTRODES

The vessel being welded is part of an L.P.G. tank truck. For high strength with low weight—USS "T-1" steel is used and welded with Arcos Ductilend 110 Electrodes. These tanks meet or exceed ASME code requirements . . . and all Ductilend 110 welds qualify with X-ray soundness. Ductilend 110 is an Arcos Low Hydrogen Electrode especially developed for welding high strength notch tough steels of the 110,000 psi tensile strength range. Data sheet on request. ARCOS CORPORATION • 1500 South 50th Street, Philadelphia 43, Pa.

For more facts Circle No. 207 on Reader Service Card



MANNING CENTER FINDER
With the Automatic Spring-loaded Punch!

For fast, precision pipe fabrication. Locate any degree from one degree to 360 degrees and establish a true center line in less than one minute. For centering, quartering or eighthing any size pipe. Automatic punch. Cuts back-charges and pipe salvaging to a minimum. Cuts labor time by as much as 90 per cent.

MANNING MFG. CO.
8202 CHANCELOR ROW • DALLAS, TEXAS

Ray Thompson says...

"Thermo Tip Cleaners are the safest and best cleaners I have ever used. The non-breakable spiral design eliminates the hazard of breaking a cleaner in a cutting tip.

"The Thermo spiral does a better job of working out the carbon and slag without damaging the inside wall. The precision tolerance keeps the tip orifice to true size, giving a straight flame."

Ray Thompson is a recognized expert, repairing thousands of cutting tips each year. He is employed by the Pacific Tip Co. of Los Angeles, Calif.

Use Thermo Tip Cleaners and cut your tip repair costs, at the same time increasing your cutting efficiency. The only cleaner with a non-breakable money-back guarantee.

Send for a free sample today and find out for yourself why Thermo Tip Cleaners are better.

All progressive welding supply dealers stock Thermo Tip Cleaners.

THERMACOTE Company
108 SOUTH DE LACEY AVENUE • PASADENA, CALIFORNIA

For more facts Circle No. 208 on Reader Service Card

Safety eyewear

Sightgard eyewear combines protection with distinctive appearance of modern functional glasses. Available in metal and acetate frames, various temple styles, rigid and adjustable nose pads. Side shields available with flesh and ebony acetate models. Line includes clear lenses in S-7 shape, round 50mm lenses and plates for filtering of sodium glare, protection against pitting and spatter. Frames provided in acetate, metal and acetate-on-metal. *Mine Safety Appliances Co.*

Circle No. 44

Brazing torch

No. 19-S Torch with 1390 H tip is designed for use with natural gas in brazing or silver soldering. It is universal pressure-operating on high, medium or low pressure, produces hot but clean flame. Unit is said to offer advantages over oxyacetylene brazing torches in lower fuel gas cost, flame with soaking heat effect, and clean, carbon deposit free, finished work. *The Harris Calorific Co.*

Circle No. 45

Cutting machine

Wallace Oscilla-Modular has cut up to 8 in. solid high alloy bars with micro finish dimensions including profilometer readings as fine as —32, manufacturer reports. Machines cut at rate of 4 to 10 seconds depending on material. Oscillations by Bellows air motors with hydraulic check, range from slow to 100 strokes per minute. Length of stroke is adjustable from ¾ in. to 6 in. Machines available in five sizes: 16 in. wheels, 18 in. wheels, 20 in. wheels, 26 in. wheels and 34 in. wheels with capacities up to 8 by 8 solid bars. *Wallace Supplies Mfg. Co.*

Circle No. 46

Hardening compound

Hard-N-Tuff, a non-toxic steel hardening compound, carburizes, nitrides and chromizes in one operation. Single application on mild steel tools, dies and wearing parts provides surface hardness of 60 to 65 Rockwell C, .003 to .006 in. deep. Deeper case may be obtained by repeated application. Parts are heated to red heat, plunged in hardening compound, re-heated, and quenched. Only standard heating equipment required. *Hard-N-Tuff Corp.*

Circle No. 47

Power supply

A 100 watt-second stored energy welding power supply, Model VTW-30, has step-free adjustable range of power of 0.5 to 100 watt-seconds. Pulse width of less than 1½ milliseconds assures no burning or discoloration of weld area and no heat damage to components welded, states manufacturer. *Hughes Aircraft Co.*

Circle No. 48

Hose reel

Model A-3 Reel-King automatic hose reel has capacity for 25 ft of ⅝ in. or ¼ in. single hose. Spring-operated reel drum locks for 170 deg of each turn and is reversed by relaxing pull on hose. Clock-type spring and ball bearings are factory lubricated. Temperature range of reel is −120 to 500 F with *maximum* operating pressure usually limited only by the hose. Connections available are: International Acetylene Association 9/16 in. 18T, right and left hand threads, male; ¼ in. nps, male, straight pipe thread for nut and gasket; ¼ in. npt, female. *United Specialties, Inc.*

Circle No. 49

Thyratron tube

Inert-gas high current thyratron is 6.4 amp, 1,000 volt peak forward and 1,250 volt peak inverse. Designated NL-6989/-C6J/KL, it has a commutation factor of 130 V/usec X A/usec. Tube available with lug, pin or bracket base. Filament volts, 2.5; filament current, 21 amp; peak anode current, 80 amp; ambient temperature limits of −55 to +75 C. *National Electronics, Inc.*

Circle No. 50

For more facts Circle No. 209 on Reader Service Card

"That's why we chose COYNE CYLINDERS—the acetylene cylinders that **hold more gas.** COYNE'S extra gas capacity means we sell **more** gas in every cylinder delivered to our customers. At the same time we also **cut** our handling, trucking and administrative costs because it takes **fewer cylinders to deliver the gas.**"

Check with COYNE—let them send you the dollar and cents facts on **how much** profit you get from this extra gas footage.

COYNE cylinder company

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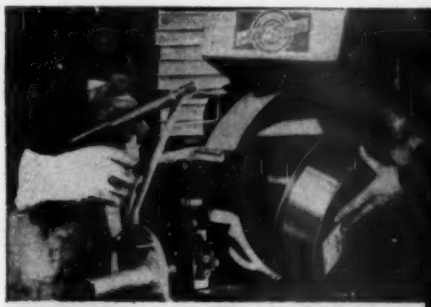
24 COMMERCE STREET, NEWARK, NEW JERSEY, MITCHELL 2-1618



Loading 10 lb. spool of #4043 aluminum wire at Michael Flynn Manufacturing Co., Philadelphia. Aluminum in this particular spool was used in welding curtain walls for skyscraper at 2 Broadway, New York City.

now you can get All-State Spoolarc

SPOOLED ALUMINUM

in all grades, all types precision layer level wound on 1 lb. and 10 lb. spools

Wire goes from extrusion and light draw to ALL-STATE'S precision spooling machines where it is layer level wound for smooth, trouble-free welds.

Types available: 1100, 4043, 5052, 5154, 5183, 5356, 5556, 6061, 6063, *355,* 356, 716, 718.

Precision spooled in these sizes: .030, .040, 3/64, 1/16, 3/32, 1/8.
*down to 1/16 only

ALL-STATE *Spoolarc*® spooled aluminum wire meets federal and industry specifications. Spools are sealed in polyethylene bags plus desiccant to retain top quality from spooling machine to welding machine.

Complete stocks available from factories at White Plains, N. Y. and South Gate, California . . . and from branches at St. Louis, Missouri and Toronto, Canada. On sale at over 1000 distributors here and abroad.

Send for new free Aluminum Manual.

Distributor-Stocked, convenient to buy. Economical to use.
ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.
Call WHite Plains 8-4646 or write for nearest distributor

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For more facts Circle No. 211 on Reader Service Card

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TO THE RESCUE
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I CAN'T STAND IT, DOC TUFFY EITHER THOSE MUSHROOMED TIPS GOTTA GO... OR I DO!
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Mushroomed spotweld tip? Don't throw it away! Toss out the worn end . . . re-use the shank! You can when you use replaceable TUFFCAP TIPS and long-life TUFFALOY SHANKS.
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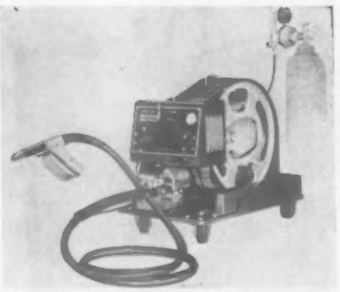

Semiautomatic welder

Magna welder with hand gun and cable assembly now can be used for gas shielded welding. Unit handles wires ranging from 1/16 in. to ⅜ in. diameter. Feed rolls and nozzle tips available for solid and tubular welding wires of mild steel, alloy steel, bronze and stainless steel. Three hand guns weld with shield of CO_2, argon or helium. *The Auto Arc-Weld Mfg. Co.*

Circle No. 51

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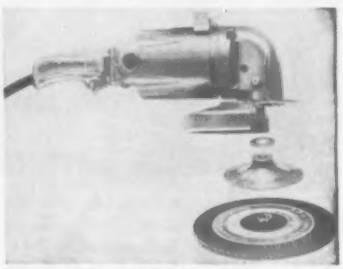
No-Arc welding gun uses ordinary 14 in. welding rod ranging from 1/32 in. to 5/32 in. in diameter. Gun needs no triggers or buttons, self-starting rod, special transformer or voltage adaptors. Bonds without distortion all gages of metal in any combination ranging from 30 gage to ½ in. steel plate. Gun operates a-c or d-c. Foot switch will break or rearc instantaneously and has no live or shorting electrodes to cause accidental flashes or accidental burning out of welding machine. *No-Arc Equipment Co.*

Circle No. 52



Grinding wheel

Raised-hub grinding wheel, type 27, has adaptor flanges and threaded steel insert molded as integral part of wheel. Flange slips on without threads and is made of heavy gage steel. Wheel always mounts at true 90 deg to spindle and runs true, states manufacturer. Standard diameter are 7 and 9 in.; standard thicknesses are ⅛, 3/16, ¼, and ⅜ in. Arbor size is ⅝ in.-11. Other size wheels or nuts available on special order. *A. P. de Sanno & Son, Inc.*

Circle No. 53

X-ray films

Sheets of X-ray film individually wrapped in expose-through packaging permits easy handling of individual sheets of film throughout exposure operation. Exposure can be made through either side of packette; both sides bear cross hair markings to aid in centering film. Films in type AA and M are available in ready packs in 8 by 10, 10 by 12 and 14 by 17 sizes. *Eastman Kodak Co.*

Circle No. 54

Book Reviews

Structural mechanics

STRUCTURAL MECHANICS, by Samuel T. Carpenter. Published by John Wiley & Sons, Inc., New York City, 1960. Cloth, 6 in. x 9 in., 502 pages. Price $9.50.

The intent of this book on structural mechanics is to present the fundamental principles so as to provide a sound background for further extended study in the field of structure. The use of calculus and differential equations is stressed. However, their uses are kept within the limits of capacity and background of the undergraduate student, so as to make the book a practical college text. However, it covers a number of modern topics, which make it a value to graduate students as well as to practical engineers.

Structural mechanics should prove valuable to structural engineers engaged in welded design. Many of the problems presented indicate that the structure being analyzed is of welded design with rigid frame, structures being amply treated.

Ultrasonic testing

RESEARCH AND DEVELOPMENT LEADING TO THE ESTABLISHMENT OF ULTRASONIC TEST STANDARDS FOR AIRCRAFT MATERIALS. Published by Office of Technical Services, U.S. Department of Commerce. By G. L. Cross and others, 1960, 147 pages. Price $2.75.

This report gives the results of a four phase study evaluating materials and techniques for the detection and evaluation of internal defects by ultrasonic means.

The report includes: (1) information on material variables in certain steel, aluminum, and titanium alloys with particular emphasis on defect size and material production methods; (2) analysis of variables involved in contact and immersed methods of inspecting sheet metal; (3) discussion of theoretical considerations regarding altering of the ultrasonic beam diameter by collimation; and (4) exploration of the possibilities of predicting static and fatigue properties of materials containing gross amounts of very minute discontinuities.

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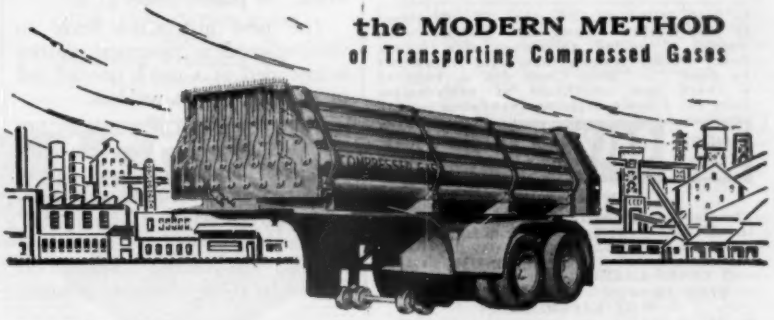

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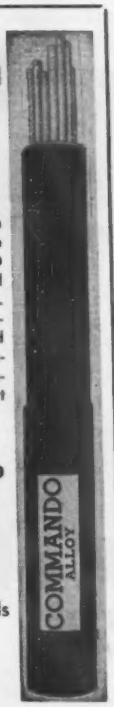

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Titanium welding

THE WELDING OF TITANIUM AND TITANIUM ALLOYS. C. E. Faulkner and C. B. Voldrich, Defense Metals Information Center, Battelle Memorial Institute, 1959, 69 pages, price $1.75.

A revision of a titanium welding report published in 1956, this latest report discusses advances in titanium welding, including use of Mig welding in the production of titanium assemblies. Other advances described are the assembly welding of titanium alloys Ti-SA1-2.5Sn and Ti-6A1-4V (previously either riveted or fabricated from commercially pure titanium) and the ASME approval of unalloyed titanium for the fabrication of unfired pressure vessels.

The study also covers general welding procedures, surface cleaning, quality control, stress relief treatment, and the mechanical properties of welded joints in titanium mill products.

Plastic welds

MAKING BETTER PLASTIC WELDS. By Donald W. Thomas. Published by Laramy Products Co., Cohasset, Mass., 56 pages. Price $1.00.

The new instruction book on welding modern structural plastics is intended as a much needed aid in training plastic weldors.

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Welding bridges

WELDED INTERSTATE HIGHWAY BRIDGES. Published by The James F. Lincoln Arc Welding Foundation, Cleveland, 1960, 269 pages. Price $2.00.

This collection of welded bridge designs comprises a review of current practice on the Defense and Interstate Highway System. The designs, which received awards in the Lincoln Foundations recent design competition, are reviewed with written discussions and drawings abstracted by the editor, James Clark, from authors' original comments and drawings.

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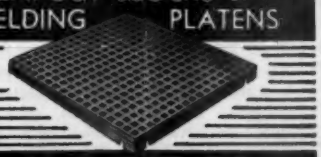

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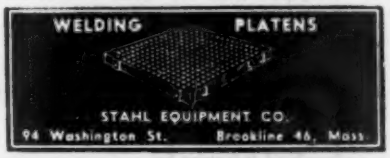

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STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF

Welding Engineer published monthly (two issues in June) at Chicago, Ill., for October 1, 1960.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Welding Engineer Publications, Inc., 5826 Dempster St., Morton Grove, Ill.; Editor, F. T. Tancula, 5826 Dempster St., Morton Grove, Ill.; Managing editor, G. J. Cannizzo, 5826 Dempster St., Morton Grove, Ill.; Business manager, T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owner must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) Welding Engineer Publications, Inc., 5826 Dempster St., Morton Grove, Ill.; T. B. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Elsie R. Jefferson, 5826 Dempster St., Morton Grove, Ill.; Anna B. Jefferson, 12 West 58th St. Terrace, Kansas City 13, Mo.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

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5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the Act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 15,530.

T. B. JEFFERSON, Publisher

Sworn to and subscribed before me this 15th day of September, 1960.

[SEAL] ROLAND F. DILG, Notary Public

(My commission expires April 12, 1962.)

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75. CHEMICAL CORROSION—The H. M. Harper Co. Card works like slide rule to show how each of eight types of metal withstands corrosive effects of 141 chemical agents.

76. HEAT EQUIPMENT—Niagara Weldments Inc. Bulletin 51 gives complete rundown of NiaWel standard and specially-engineered heat transfer and process equipment.

77. WELDING ELECTRODES—Hobart Bros. Co. Welding electrode wall chart gives description, number, color code, mechanical properties, size, current range, procedure and information on firm's arc welding electrodes.

78. CORROSION EFFECTS—Notter Corp. Bulletin 101 shows corrosive effects of almost 400 different materials on 16 types of metals.

79. ALLOY BRAZING—Handy & Harman. Bulletin describes in detail the packaged, self-study Handy & Harman Silver Brazing Training Course.

80. CENTER FINDER—Manning Mfg. Co. Data sheet shows full size drawings of center finder with automatic punch for fabricating pipe in any degree and gives information on its use.

81. RESISTANCE WELDERS—The Federal Machine and Welder Co. 12-page brochure in color, Federal BT-60 illustrates and describes line of resistance welders.

82. STUD SPECIFICATIONS—Shielded Stud Welding Co. Six-page pamphlet gives shielded welding stud specifications; four-page bulletin lists shielded stud welding equipment.

83. WORK GLOVES—Riegel Textile Corp. Manual covers basic types and styles of work gloves with tips on basic cuts, grades of leather, chemical resistance and physical properties of plastic coatings.

84. PNEUMATIC COMPONENTS—Alkon Products Corp. 24-page catalog lists complete line of cylinders, drill units and valves with complete line of pneumatic and hydraulic components.

85. GAS FLAME—Smith Welding Equipment Corp. Four-color wall charts show traits of oxy-LP gas flame in comparison with oxyacetylene flame.

86. WEAR PROBLEMS—Ampco Metal, Inc. Welding News, second quarter, discusses common steel mill wear problems and practical repair solutions.

87. MAINTENANCE WELDING—Eutectic Welding Corp. Data book gives application and design data on maintenance welding in 148 illustrated pages.

88. GAS HEATERS—Insto-Gas Corp. Catalog illustrates line of gas heaters and heating accessories.

89. BUS DUCT DATA — Westinghouse Electric Corp. Application data for low-impedance bus duct is contained in new 20-page booklet No. 30-662 — descriptions, drawings, dimensions, specifications, engineering and test data.

90. FLASH-BUTT WELDERS—Taylor-Winfield Corp. Bulletin 7-213-A describes manufacturer's B-5 flash-butt welders with photographs of various types and applications.

91. FIRE EXTINGUISHERS — Cardox Div., Chemetron Corp. Fire extinguishing equipment for power plants and electrical installations, and use of carbon dioxide for generator purging are described in bulletin C162-3560.

92. PLASTIC WELDING KIT—American Agile Corp. Two-page data sheet details firm's new plastic welding kit, designed for field or in-plant maintenance, or production welding of any thermoplastic fabrication.

93. ADJUSTABLE EXTENSOMETER—Testing Machines, Inc. Brochure No. 522 illustrates and describes single-piece adjustable extensometer, which indicates the elongation of metallic and plastic specimens.

94. CALCIUM CARBIDE — National Carbide Co. Attractive 16-page brochure, "The many faces of calcium carbide," traces history of calcium carbide and discusses its many present-day applications.

95. TAPER-FACE FLANGES — Tube Turns Div., Chemetron Corp. Expanded size range for taper-face flanges is described in revised bulletin TT 942.

96. BENDING MACHINES — Wallace Supplies Mfg. Co. Complete line of rotary benders for the forming of tube, pipe, bars, structural shapes, channels, etc. from steel, stainless steel, copper, brass, aluminum, etc. are described in catalog.

97. BEVELER — American Pullmax Co. Information on firm's X-8 Beveler available, including prices.

98. ALLOY QUALITIES—Coast Metals, Inc. Detailed information on alloys for abrasion, impact, corrosion and heat resisting services is contained in new series of engineering data sheets bound in heavy paper cover.

99. ALLOY STEEL BAR — LaSalle Steel Co. Bulletin No. 22 lists specifications of alloy steel bars which eliminate need for heat treatment.

100. SADDLE FITTINGS — Allied Piping Products Co., Inc. Form 5-60 contains details, with illustrations, on pipe saddle fittings.

101. CABLE CONNECTORS—Bernard Welding Equipment Co. Two-page Bulletin 102 provides brief description of firm's "Red-E" cable lugs & splices, which connect to cable in seconds; using just a hammer; includes prices.

102. FLAME HARDENER — Victor Equipment Co. Features of roller flange flame hardener are briefly discussed in flysheet (Form VH-3).

103. WELDING ALLOYS—All-State Welding Alloys Co., Inc. 56-page welding, brazing and soldering alloy and flux catalog and instruction manual includes charts and tables summerizing alloy selection and properties.

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BUSINESS REPLY CARD

First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids,
Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Advertisers' Literature

Literature offered in advertisements which were received up to the 5th of last month. To get the literature you want, circle numbers on Reader Service Card on this page.

210. All-State Welding Alloys Co., Inc. — Aluminum manual available on "Spoolarc" spooled aluminum wire.

173. American Platinum & Silver Div. — Booklet available, "A Complete Guide To Successful Silver Brazing."

182. Ampco Metal, Inc. — Bulletin W-17 on "Ampco-Trade" and "Phos-Trode" electrodes and wire.

220. Anaconda American Brass Co. — Publication B-13 available, "Anaconda Welding Rods and Procedures for Welding Copper and Copper Alloys."

154. Bernard Welding Equipment Co. — Bulletin 102 available on Bernard cable connectors.

178. Bridgeport Brass Co. — Booklet available, "Bronze Welding."

172. Budd Co. — Gamma Radiography Bulletin available.

186. Electric Arc, Inc. — Brochure available "Smith-Dolan System of Low-Frequency Induction Heating."

187. Fibre-Metal Products Co. — All types of helmets manufactured by Fibre-Metal are described in Catalog No. 26.

198. Frommelt Industries, Inc. — Catalog available on safety products manufactured by Frommelt including the wrap-around safety shield.

216. Galv-Weld Products — Information and sample of galvanizing manufactured by Galv-Weld.

157. Glenn Pacific Power Supply Corp. — Literature and specifications on the new "Glenn Variable Slope" constant voltage power supplies.

153. Goldsmith Brothers — A free working sample of GB 88 flux for silver brazing will be supplied on request.

151. Hobart Brothers Co.—Write for samples of the Hobart "Rocket LH" low hydrogen electrode.

152. Hobart Brothers Co. — Catalog availalbe describing Hobart "ADI" model welder and other welders manufactured by Hobart.

166. The International Nickel Co., Inc. — Booklet available, "New Inco-Hard "1" Electrode for Hard-Surfacing" further explains the hardfacing process when using Inco electrodes.

162. Invincible Vacuum Cleaner Mfg. Co. — Send for Invincible Flux Recovery equipment folder.

150. Jackson Products — Catalog on the "Sealed Tight" series holders is available.

213. Lucas Milhaupt Engineering Co. — Brazing handbook available, "The Path to Better Brazing."

199. Merrill Brothers — Catalog C-2 describes the Fork Lift Attachment and other material handling devices.

197. Metal & Thermit Corp. — Data sheet available on "Murex" welders.

163. Page Steel & Wire Div. — Booklets DH-402 and DH-1218 available on automatic welding wire.

196. Phoenix Products Co. — Descriptive literature available on "DryRod" electrode ovens.

165. Rankin Mfg. Co. — Bulletin No. R101 on the new "Ranomatic" wire for automatic and semi-automatic hardfacing, is available.

192. Riegel Textile Corp. — A Glove Guide to help you select the glove that gives the greatest protection is available.

167. Simonds Abrasive Co. — Bulletin ESA 244 available on the new "Double XX" wheels for weld grinding.

206. Singer Glove Mfg. Co. — New catalog available on screens, work gloves, welding gloves and safety clothing.

169. A. O. Smith Corp. — For further details on the new Button Weld made with "C-Omanuel" send for Bulletin MW-253.

179. Stoody Co. — Completely illustrated folder on all Stoody wires is available.

211. Tuffaloy — **Air Reduction Sales Co.** — Tuffaloy Catalog and price list available.

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BUSINESS REPLY CARD

First Class Permit No. 32, Morton Grove, Ill.

Welding Info-Aids,
Welding Engineer
P.O. Box 28
Morton Grove, Ill.

Name ..... Title .....

Company .....

Address .....

City ..... State 11/60

NOT GOOD AFTER FEB. 1, 1960

WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill.

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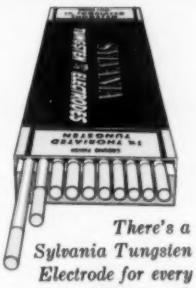
makes ductwork duck soup

Whether you're welding the ventilating ductwork for a giant skyscraper, a transcontinental Big Inch, or hardware for outer space, TIG welding speeds the job and makes it easier. And for this kind of work, no finer Tungsten Electrode is made than by Sylvania.

Sylvania offers the most complete line of top-quality Tungsten Electrodes: Puretung®, Zirtung®, 1% Thoriated, 2% Thoriated. Each comes in the preferred finish—cleaned or ground, and color-coded to save time and prevent costly errors. Chemical & Metallurgical Division, Sylvania Electric Products Inc., Towanda, Pennsylvania.



There's a Sylvania Tungsten Electrode for every welding need.

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For more facts Circle No. 219 on Reader Service Card

WELDING CLINIC

J. Imperati and R. F. Pulver, Welding Engineers
Anaconda American Brass Co., Waterbury, Conn.

Spooled copper electrodes and Aircomatic Process help simplify welding of heavy-duty connectors

Fabrication of copper cathode straps and anode flexes for an aluminum potline is simplified and expedited by inert-gas consumable-electrode welding using spooled electrodes of Anaconda Copper-372. At the Reynolds Metals reduction plant in Gregory, Texas, one operator makes 12 welds, each about ¾" thick by 3" wide, in 12 to 15 minutes, using an Aircomatic Model 21 torch, argon shield, and 3/32" diameter electrodes.

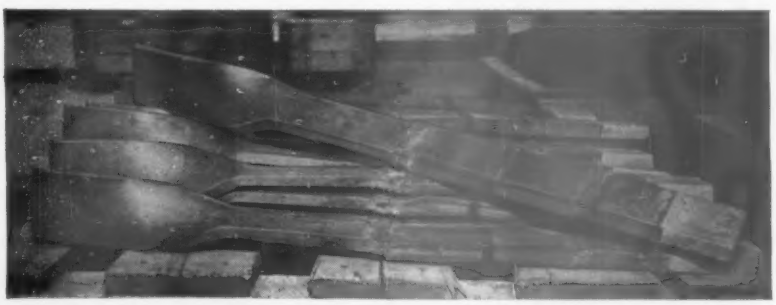
ANACONDA COPPER-372 Welding Wire, layer-wound on standard 25-pound spools, is carefully cleaned and shipped in a special carton. Supplied to Reynolds by Big Three Welding & Equipment Co., Corpus Christi, Texas.

TOUGH SERVICE CONDITIONS. Anode flexes installed on the potline are subject to very high temperatures. These are the same construction as the cathode straps, shown at left below, except that the flexible portion is longer.

The connectors consist of solid copper bus bars joined by flexible packs of 36 leaves of 24 B&S gage (0.0201"), 3" wide copper strip. The joints are welded over carbon back-up plates. Usually, welding of ¾" thick sections requires the use of single-, or double-vee grooves. Reynolds found that with inert-gas consumable-electrode welding, these butt joints can be made without beveled-edge preparation by simply spacing the edges ¼" apart.

The ease and speed of inert-gas consumable-electrode welding of copper has led to its widespread use, not only for joining bus conductors, but for the fabrication of pressure vessels and other equipment. Anaconda Copper-372 Welding Electrodes are available in sizes from .035" through ¼" on standard 25-lb. spools.

FOR MORE INFORMATION. Anaconda distributors will gladly help in the selection of the exact rod for your job. But if you have a special problem, Anaconda specialists will be glad to help you. For this service, or a copy of Publication B-13, "Anaconda Welding Rods and Procedures for Welding Copper and Copper Alloys," write: Anaconda American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 6081 L



A SKID load of completed cathode straps ready for installation on the potline.

ANACONDA®
WELDING RODS
Made by
Anaconda American Brass Company